SEND Signal Elektronik GmbH

GEOLON-MES

Marine Exploration Seismocorder

User Manual

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User Manual

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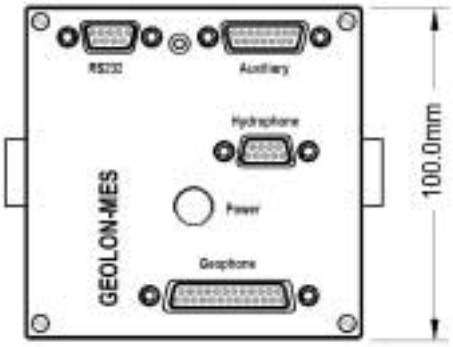
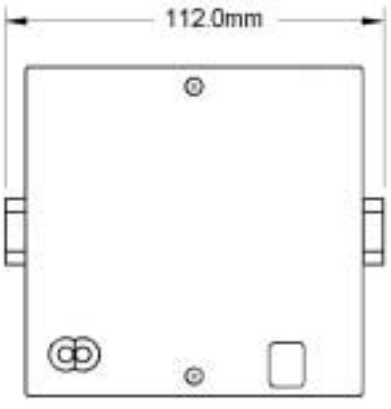
1 Technical Data

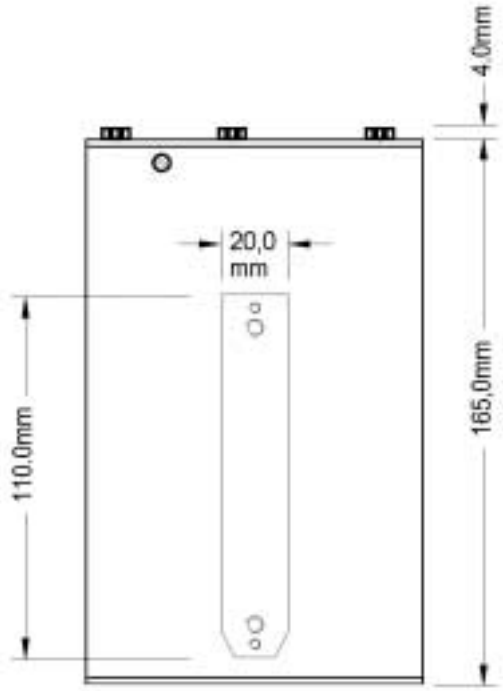
Number of inputs	4 differential input channels 3 geophone inputs and 1 high impedance hydrophone input
Input sensitivity	software selectable from 5 V_{pp} to 80 mV_{pp} in seven steps
Sample rate	125, 250, 500, 1000, 2000 Sps, (8 ms, 4 ms, 2 ms, 1 ms, 0,5 ms)
Frequency range	DC - 0.42 * sample rate
Resolution	24 bits
Signal-to-noise ratio	> 130 dB
Internal oscillator drift	< 0.03 ppm @ -5 - +40 °C
Time synchronisation	DCF77 or GPS time pulse
Storage medium	30 GByte hard disk
Storage interface	IEEE 1394 Firewire transfer rate: 5 GB in < 10 min
Engineering signals	Temperature, Humidity, Battery voltage, 3 additional analog inputs, 0 -2.5 V, 12 bits resolution sampled every minute
Power supply	10 - 30 Volt
Power consumption	200 µA shutdown, 0.26W standby, recording 1 channel: 1 W recording 3 channels: 1.3 W recording 4 channels: 1.5 W
Weight	1,3 kg

Top View



Bottom View



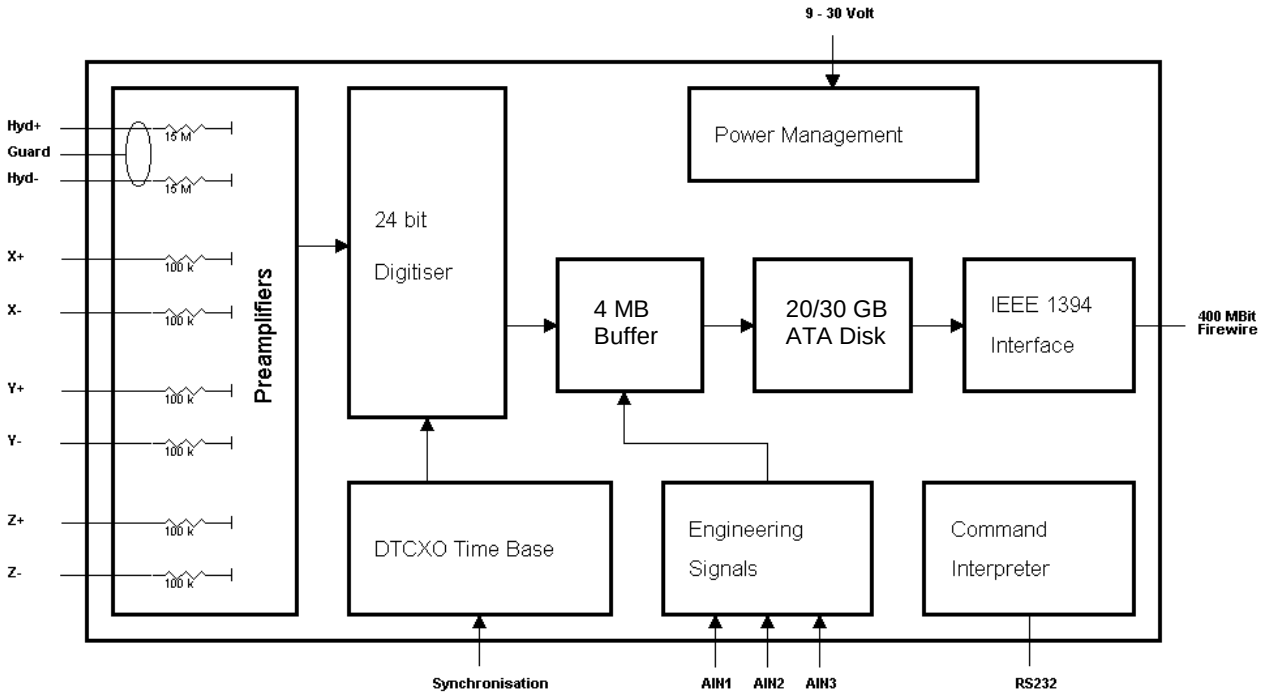


Side View

2 Functional Description

2.1 General

GEOLON-MES is a seismic exploration data logger optimised for the marine environment.



Block Diagram

One Hydrophone, one 3-component geophone or all 4 components may be recorded using differential input signals. The pre-amplification is software selectable in seven 6 dB steps from 0 dB - 36 dB. Then each channel is digitised using a high-performance 24-bit sigma-delta A/D-converter that produces software selectable sample rates needed for seismic exploration.

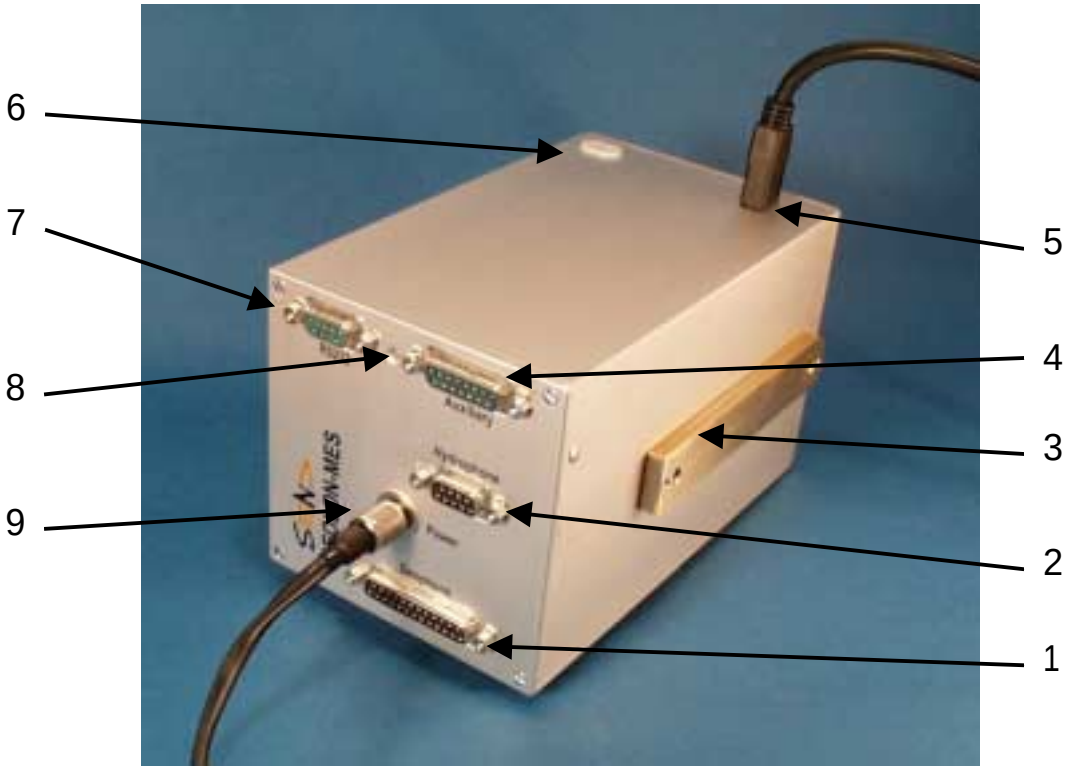
A high-performance 'digitally temperature compensated crystal oscillator' (DTCXO) produces timing signals that are synchronised before deployment using GPS time signals. The time information together with the sampled data is temporarily stored in a 4 MB buffer. In addition, internal (temperature, humidity, battery voltage) as well as 3 external engineering signals are recorded every minute. Whenever the buffer is full, a 20/30 GB hard disk is powered up and the buffer is transferred to the disk.

- Configuration and parameterisation of GEOLON-MES may be carried out interactively via a PC using the communication program **`SENDCOM.EXE`.**

Configuration data is stored in non-volatile memory to make GEOLON-MES independent from the external PC during data recording. The interactive configuration uses the serial RS232 port (COM1 or COM2) of the PC, communicating at 19.2 kBaud (8N1).

After deployment and recovery the recorded seismic data as well as the engineering signals are copied via an IEEE-1394 Firewire interface to a Linux-PC (see also chapter 7.3). The program library SEND2X can be used to decompress the data and to convert it into a binary, audio-wave or SEG-Y format.

2.2 Elements



1 connector for three component geophone

2 connector for hydrophone

3 fastening (optional)

4 Auxiliary connector

5 IEEE 1394 (Firewire) connector with plugged cable

6 Screws for internal clamp connectors with plugs at the bottom side, for power supply by single wires

7 RS232 connector

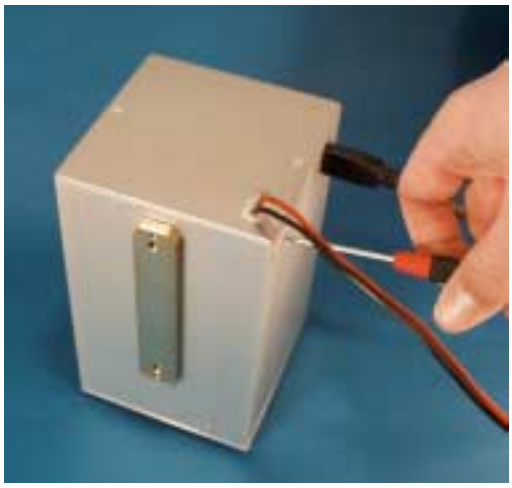
8 LED

9 Connector for power supply by cable

3 Hardware Description

3.1 Power Supply

Power has to be supplied to GEOLON-MES with an input voltage range of 10 - 30 Volts either via the clamp terminals on the bottom side or via the connector on the top side.



Power supply via terminals at bottom side

Power supply via connector at top side

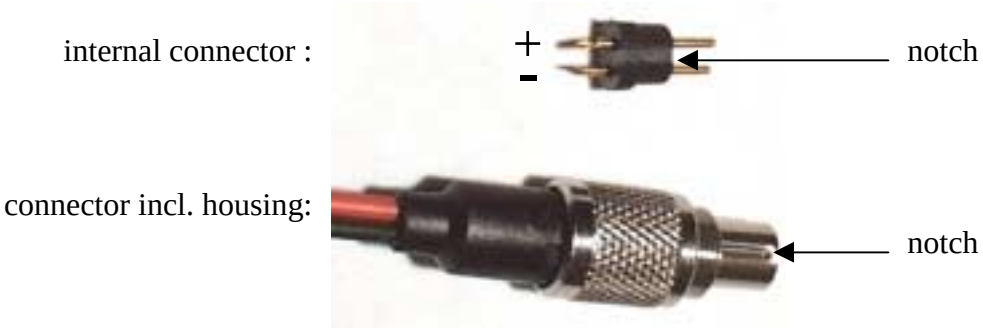
The integrated high-efficiency DC/DC converter has a "low-battery" detector that triggers as soon as the input voltage falls below 8 Volts. Once the low-battery detector has triggered, the input voltage has to be raised above 10 Volts again to reset it.

If the low-battery status is sensed during data recording, recording is terminated immediately and GEOLON-MES goes into standby-mode. All data prior to low-battery detection will be safely stored on the internal disk.

A large storage capacitor buffers the power supply for the oscillator and time base module. Therefore, GEOLON-MES may be disconnected from the power supply for up to 30 seconds before it looses time synchronisation once established.

3.2 Power connector

The Binder-plug at the front of MES has to be connected as follows:



3.3 RS232 Interface

The GEOLON-MES operates as a DCE device, so a straight 9-pin modem cable is needed to connect it to a COM interface on the PC. The PC always operates as a DTE device, thus all signals adhere to the standard RS232 pin-out.

Pin	Signal	Remarks
1	DCD	always high (+5V)
2	RxD	output from DCE to DTE
3	TxD	input from DTE to DCE
4	DTR	input from DTE to DCE - wake-up signal
5	GND	
6	DSR	always high (+5V)
7	NC	not used
8	CTS	output from DCE to DTE
9	/DCF77	synchronisation input, connected to pin 3 of the auxiliary connector

After connecting MES to the power supply, the MES waits for a DTR signal before it can start the boot sequence. The DTR signal usually will be provided by a terminal program (like SENDCOM) via the RS232 interface. Another possibility is to connect pin 4 to a voltage between +3 and +9 Volt, using pin 5 for signal ground level.

3.4 Auxiliary Signals

This 15-pin D-SUB connector (sockets) carries all signals which are needed for synchronisation, external triggering etc. Different plugs should be prepared to control the required function.

All logic inputs and outputs are TTL-compatible signals.

Pin	Signal	Remarks
1	+5V	output; power supply, 10 Ohm resistor in series
2	AGND	Ground return for single ended analog inputs
3	/DCF77 or 1pps of GPS	input for time synchronisation, active-low, 1 kOhm pull-up connected to pin 9 of the RS232 connector
4	SYNCHRONISED	output, high when synchronised
5	RECORDING	output, high while recording data
6	Master_out	output for synchronising other Geolon-MES units
7	TRIGGER or NMEA-UART	input for external trigger, active-high, 10 kOhm pull-down or input of NMEA string of GPS
8	RELEASE	output, active-high, see RELEASE command
9	AIN1	analog input into a 12-Bit A/D-converter for engineering signals
10	AIN2	analog input into a 12-Bit A/D-converter for engineering signals
11-15	DGND	Ground return for all logic in- and outputs

3.4.1 /DCF77 or GPS

The time synchronisation input is used to set the time and date using a DCF77 or GPS compatible pulse pattern. Both signals synchronise on a high-low transition to mark the beginning of a second. The GPS receiver used has to be configured for sending the NMEA signal with following settings: 4800 Baud rate, 8N1 modus, no follow control, sending GPZDA and GPGGA strings.

3.4.2 SYNCHRONISED

This output is set to a high level as long as time synchronisation is maintained.

3.4.3 RECORDING

This output is set to high level while data are being recorded. It is set to low level during the idle phase of an interval.

3.4.4 Master_out

This is an uncommitted output that may be used for customer specific signals.

3.4.5 TRIGGER

This input may be used to start and stop recording of data if the trigger has been activated using the EXTERNAL command. As long as the input is at a high-level, data are recorded. While the input is at a low-level, data recording is halted.

Each time the trigger is activated, a new recording sequence is started.

3.4.6 RELEASE

As soon as the release time is reached this output switches to high level. The release time can be set using the RELEASE command.

3.4.7 AIN1, AIN2, AIN3

These inputs are sampled every minute by a 12 bit A/D-converter. The input range is from - 1 to + 1 Volt. That means:

- 1 Volt generates a hexadecimal number $800,
0 Volt generates a hexadecimal number $000,
+1Volt generates a hexadecimal number $7FF.

While AIN1 and AIN2 are connected to the 15-pin D-SUB connector for auxiliary signals, the input of AIN3 is possible via pin 22 at the D-SUB 25 socket for geophones (please see chap. 3.6).

3.5 Analog Inputs

The GEOLON-MES has four differential input channels for 4C recordings.
Channel 1 has a very high impedance of 30 MOhm as well as a guard output to directly connect to a hydrophone. Channels 2 - 4 have an input impedance of 200 kOhm for connecting to geophones. Either the hydrophone channel or the geophone channels alone or all four channels may be activated using the **CHANNEL** command.

The preamplifier gain for each channel may be set using the **GAIN** command. The minimum amplification factor is 1 and the maximum is 64 in 7 discrete steps of 6 dB each.

The input sensitivity UIN_{0dB} can be determined using the following formula:

$$UIN_{0dB} = 5\ V\ /\ GAIN \quad [V_{pp\ differential}]$$

and $1 \leq GAIN \leq 64$ in seven steps

3.6 3-Component Geophones

D-SUB 25 sockets. Here the case of GEOLON-MES is connected to analog ground.

Pin	Signal	Remarks
1, 3, 5, 7, 15, 17, 19	AGND	analog ground
2	GEO_Z-	differential input of the Z-component, 100 kOhm to AGND
4	GEO_X-	differential input of the X-component, 100 kOhm to AGND
6	GEO_Y-	differential input of the Y-component, 100 kOhm to AGND
8	AUX1	auxiliary logic input or output under software control
9	AUX3	auxiliary logic input or output under software control
10, 20, 25	GND	ground return for AUXn logic in- and outputs
11	+5 V	sensor power supply
12	-5 V	sensor power supply
14	GEO_Z+	differential input of the Z-component, 100 kOhm to AGND
16	GEO_X+	differential input of the X-component, 100 kOhm to AGND
18	GEO_Y+	differential input of the Y-component, 100 kOhm to AGND
21	AUX2	auxiliary logic input or output under software control
22	AUX4/AIN3	auxiliary logic input or output / analog input 3
13, 23, 24	NC	not used

Please Note!
Following translations will be carried out using SEND2X:
Pin 2+14 => GEO_Z => channel 2
Pin 4+16 => GEO_X => channel 4
Pin 6+18 => GEO_Y => channel 3

3.7 Hydrophone

The hydrophone input is fed into a 9-pin D-SUB connector (sockets).

Pin	Signal	Remarks
1	+5V	sensor power supply
3	HYD+	differential hydrophone input into CS3302, 15 MOhm to AGND
4	HYD-	differential hydrophone input into CS3302, 15 MOhm to AGND
5	-5V	sensor power supply unregulated!
7	GUARD	guard output for hydrophone cable shield
8,9	AGND	analog ground

4 Error Indication

If an error occurs during deployment, an error log will be stored in non-volatile memory. Each log includes the time and date, the task in which the error occurred and a brief error description.

If GEOLON is reset or if it is switched on after an error, an error report is displayed following the sign-on message. After the report, the user may choose to erase the report or retain it in non-volatile memory for a later time by answering "y" or "n" to the prompt.

After the CLOSE or the **DCFSKEW** or **GPSSKEW** commands are executed to close an experiment, all error messages are displayed and transferred to the internal hard disk.

5 PC Software

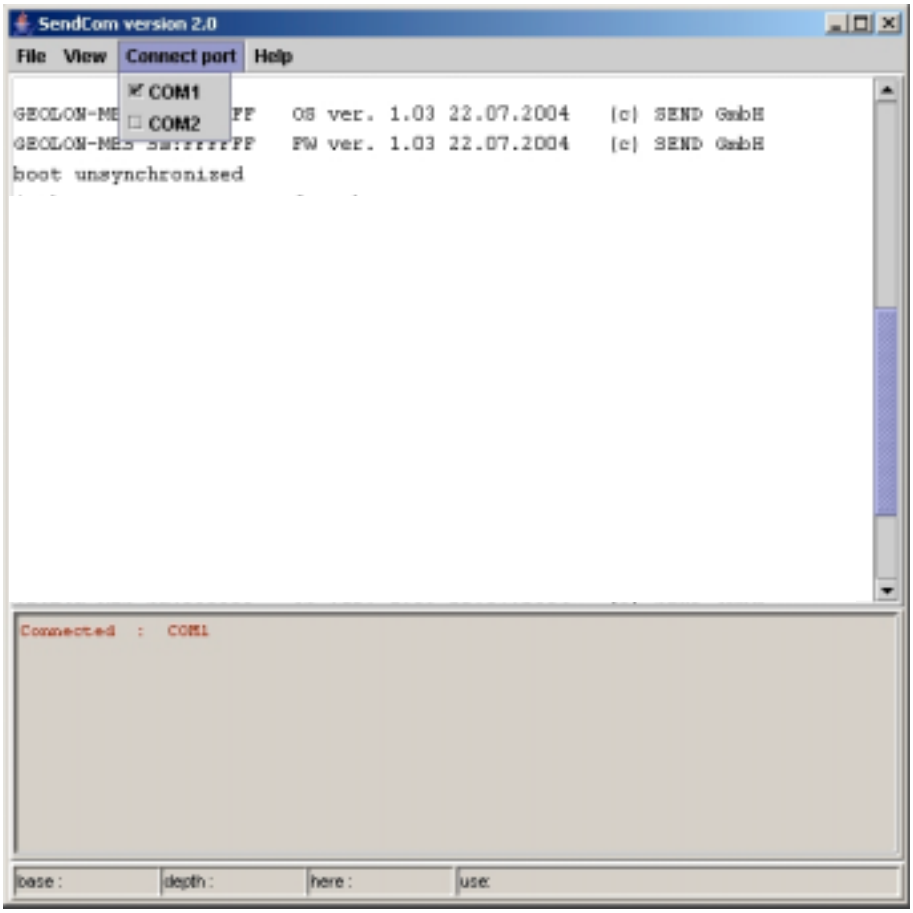
The CD-R with PC software contains the following programs:

SENDCOM
SEND2X

5.1 SENDCOM

This program is used to communicate with GEOLON-MES via the RS232 interface, e.g. for automatic booting of MES, interactive configuration (using the commands as described in chapter 6) and for display of recorded data on the PC monitor by using the SHOW command.

SENDCOM is a JAVA program, which runs on both WINDOWS and LINUX operating systems. For installation of the JAVA utilities required, please carefully read the installation-instructions on the CD-R. After starting SENDCOM, a window like the following appears:



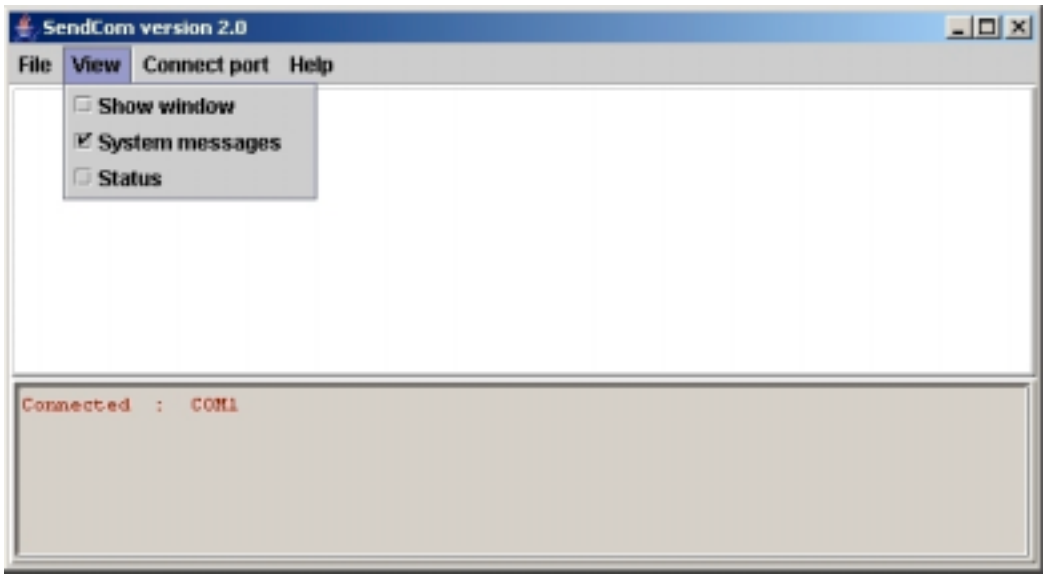
As default, SENDCOM uses COM1 as communication port. If you want to connect to COM2, you have to click on the 'com2' button in the 'connect port' option.

In the first part of window under the menu bar, you can enter commands manually. Messages from the operating system of the MES will also be displayed here.

The second part of the windows displays messages by SENDCOM (e.g. about switches between com ports).

The lowest part of the window displays status information of the connected recorder (e.g. about the current memory stack depth or the loaded firmware file).

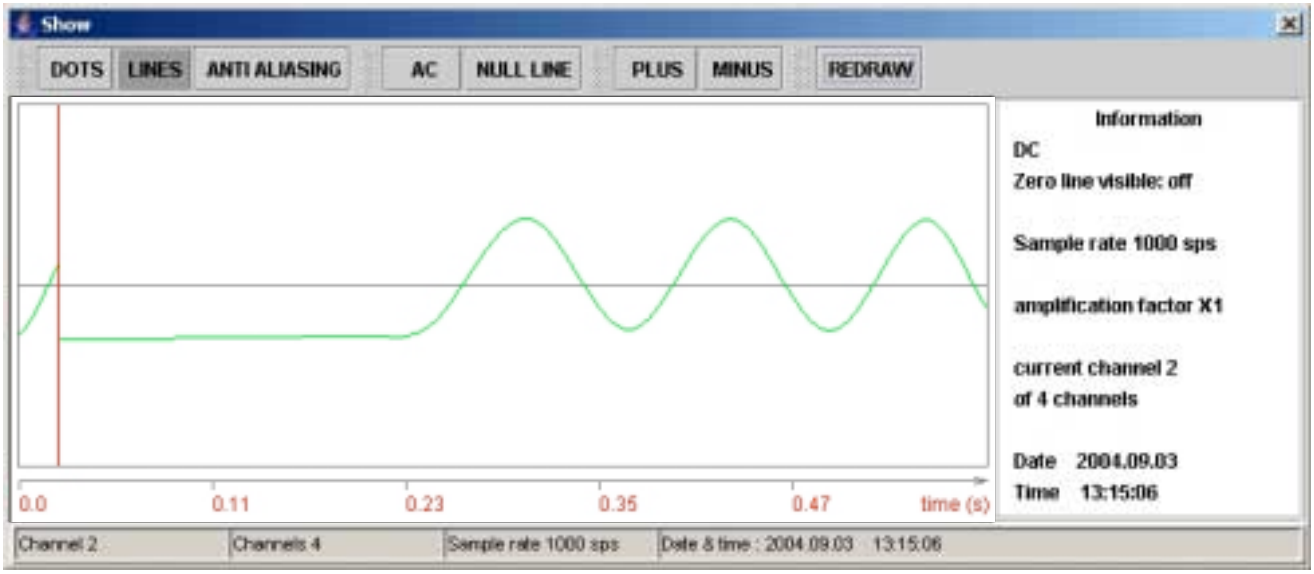
The display areas for system messages and status information can be switched off by using the 'View' option:



The **SHOW** command can be used to display the current signals at a selected channel. SHOW may be used to check the proper operation of the sensor electronics prior to starting an experiment.

<string> SHOW
displays data of channel <string>, so <string> selects the channel to be displayed. ^C (ctrl-C) will terminate the command.

With the current development stage of SENDCOM, SHOW can only be activated by typing in the SHOW command. After entering the command following window pops up:



On the top menu bar, the activated options are marked by darkened buttons. In the example displayed above, the option LINES is activated. LINES connects the data points by a line. Other options are:

DOTS:	only the data points will be displayed
ANTIALIASING:	smoothes stepped lines, which are generated due to insufficient resolution of the screen
AC:	in AC mode, any DC offset will be removed
NULL LINE:	although the null line will be displayed as grey line already, this option activates a modus in which each second data dot will be set to null and marks the null line
PLUS:	Amplifies current signal by a factor of 2
MINUS:	Decreases current signal by factor of 2
REDRAW:	Redraws the screen, use in case of display artefacts

For the recorder MLS and MES the current status of the options will be displayed in the 'information' field at the right side of the SHOW window.

Due to the maximum transfer rate of the data via the RS232 interface, a time delay in the display of the signals can appear for sampling rates of about 500 Hz and higher (depends on PC capability). For these frequencies not all data can be displayed, so a small time gap exists between two redraws of the screen.

Exiting the SHOW window and SENDCOM

Please click on the X button on the right top corner of the window for closing the SHOW window.

To exit SENDCOM you can either click on the exit option in the file submenu or click on the X button on the right top corner of the SENDCOM window.

5.2 SEND2X

This program-package converts the compressed recordings of GEOLON-MES into different formats. SEND2X currently is available for the Linux operating system only. Adaptations for other operating systems are under development.

The current version allows the conversion of raw data into a binary file, an audio-wave file, or into the SEG-Y format if an appropriate shot file is available.

On the delivered CD-R you will find a program-library and a script, which includes an example of combining the different programs. Each of the programs can be used separately.
Concerning GEOLON-MES, the library includes following programs:

mescopy
meslog
mesread
binwrite
wavewrite
segywrite

All programs using as input device the standard input, partly as output device the standard output. This allows an easy combination of the different programs through 'piping'.
A detailed description of SEND2X can be found in the Appendix.

5.3 Files

The nomenclature of the automatically generated files will be described hereafter.

5.3.1 Log - File

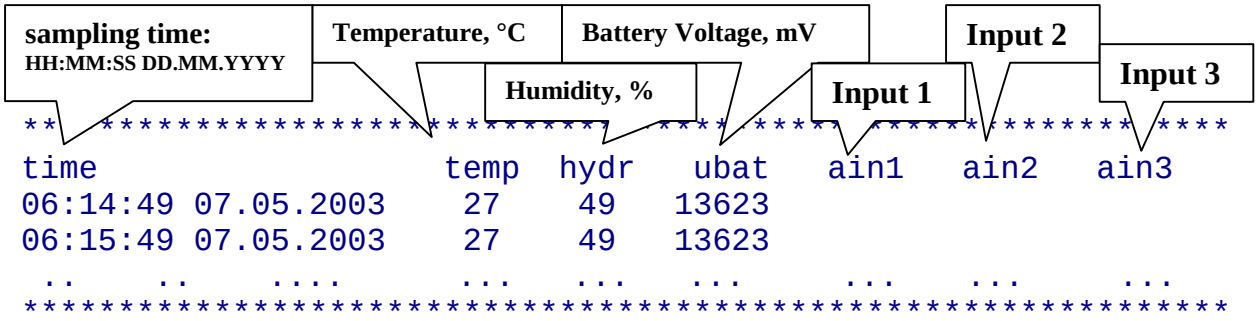
All control, status, and identification information of the current experiment are stored on GEOLON's harddisk. Furthermore, the log data includes the parameter settings such as the sample rate and the amplifier gain for each channel. Normally the program meslog displays these data on the screen. Through the assignment of the standard output to the harddisk on the connected external PC, these data can alternatively be stored in a text-file. The user has to define the filename and the destination directory in the form of *log file_ name*.txt.

An example of a log-file is shown in chapter 7.5.

5.3.2 Engineering data

The internal temperature and humidity as well as the battery voltage will be stored together with the recorded seismic data on the internal disk. The program mesread provides the extraction of the engineering data out of the recorded data stream. As for the log-file, the destination directory and the filename for the engineering data has to be defined manually. We recommend to use the extension '.eng'.

The engineering data file looks like:



Input 1-3: free channels for user defined information

5.3.3 Data Files

The programs binwrite, wavewrite and segywrite automatically generate files with names according to the following nomenclature:

020806.01.00.01.2002.168.07.09.57.extension

serial number of GEOLON	channel no	sequence no	event no	start time of recording at activation of REC command	
					.bin for binary files **.wav** for audio wave files **.segy** for files in SEG-Y format **.eng** for engineering data

The start time of recording consists of:

the year	2002
number of days since the beginning of the year	168
the hour	07
minutes	09
seconds	57

6 Command Description

GEOLON is controlled by commands, which are transferred via the program SENDCOM and RS232 interface. This chapter describes these commands, their parameters and their functions.

Before you can set up a communication, GEOLON-MES has to be connected to the power supply. After the SENDCOM program has been started, the recorder automatically boots with the last stored settings. If the space key on your keyboard is pressed and held during the booting procedure of GEOLON, a dialogue will be displayed that allows to restore the default system settings (see chap. 7.1.2).

The commands may be issued in any order and they are stored in non-volatile memory so that the current state will be retained even if power is removed. Please be aware that GEOLON will loose time synchronisation after removing power for an extended period (longer than 30 seconds).

Several commands may be entered in the same line separated by spaces.

Available Commands in Alphabetic Order

Command	Command Group	Page
ALL	Configuring the A/D Converter	17
CHANNELS	Configuring the A/D Converter	17
ChanName	TEXTINFO Parameters	22
CLOSE	Time and Storage Services	20
COMMENT	Definition of a Measurement Sequence	18
CONTINUOUS	Interval Definitions	19
DCF77	Time and Storage Services	20
DCFSKEW	Time Services	21
DRIFT	Time and Storage Services	21
END	Definition of a Measurement Sequence	18
ENDLESS	Definition of a Measurement Sequence	18
ERRORS	Information Commands	16
EVERY	Interval Definitions	19
EXPERIMENT	Definition of a Measurement Sequence	18
ExpNumber	TEXTINFO Parameters	21
EXTERNAL	Interval Definitions	19
FOR	Interval Definitions	19
FORMAT	Time Services	20
GAIN	Configuring the A/D Converter	17
GEOPHONE	Configuring the A/D Converter	17
GPS	Time and Storage Services	20
GPSSKEW	Time and Storage Services	21
HYDROPHONE	Configuring the A/D Converter	17
INTERVAL	Interval Definitions	19
LOG	Information Commands	16
MIN	Interval Definitions	19
MS	Configuring the A/D Converter	17
TEXTINFO	TEXTINFO Parameters	21
? <Questionmark>	Listing of all commands	16

Command	Command Group	Page
RATE	Configuring the A/D Converter	17
REC	Definition of a Measurement Sequence	18
RELEASE	Time Services	21
SEC	Interval Definitions	19
SETTINGS or ST	Information Commands	17
SHOW	Displaying Data	19
SHUTDOWN	Power Management	22
START	Definition of a Measurement Sequence	17
StatComment	TEXTINFO Parameters	21
StatName	TEXTINFO Parameters	21
StatNumber	TEXTINFO Parameters	21
STOP	Definition of a Measurement Sequence	17
SYNCHRONISE	Time Services	20

6.1 Help

Each command is accompanied by a short help text line, which briefly shows the input parameters. To display the help text, the command must be preceded by a question-mark.
Example: (values in <> are variables which must be entered):
?CHANNELS <cr>
this command displays on the screen:
<HYDROPHONE, GEOPHONE, ALL> CHANNELS
(for explanation, please see 6.3)
?
displays a list of all commands.

6.2 Information Commands

ERRORS
If errors happened during recording, the according messages will be stored internally. The command 'errors' allows to display theses messages on the computer screen every time when SENDCOM is activated. Older firmware versions of the MES are displaying these messages only once during the boot process.

LOG
displays the log-file a of a completed measurement campaign on the terminal screen. For details, please see chapter 5.3.1. The space-key can be used to stop the listing and start the listing again.

The following commands display information on the current setting of parameters.

SETTINGS or its short synonym ST
reports the actual setting of most configurable parameters and some additional information about the current status of the MES recorder.

TEXTINFO
reports the setting of the TEXTINFO-record descriptive strings. The TEXTINFO parameters can be used to store survey parameters (e.g. station number or comments about the survey)

6.3 Configuring the A/D Converter

While GEOLON is in command-mode (before issuing the REC command), following parameters for the A/D converter may be set:

<n> CHANNELS
determines the channels to be recorded. <n> may be 1, 3 or 4. Instead of these numbers, descriptive strings can be used: HYDROPHONE for 1, GEOPHONE for 3 and ALL for 4. For example:
1 CHANNELS or HYDROPHONE CHANNELS
3 CHANNELS or GEOPHONE CHANNELS
4 CHANNELS or ALL CHANNELS

<n> <chan> GAIN
sets the gain for the analog preamplifier of <chan> (that can be 1, 3, 4, HYDROPHONE, GEOPHONE or ALL). <n> may be any power of 2 number between 1 and 64. A full scale signal requires an amplitude of 5 V_{pp} at the A/D converter input.

<n> MS
converts <n> milliseconds to the corresponding frequency. This command can be used as a prefix to the RATE command for convenience.

<n> RATE
determines the sampling rate <n> in samples per second. Valid sample rates are 1000 (1 ms), 500 (2 ms), 250 (4 ms) and 125 (8 ms).

6.4 Definition of a Measurement Sequence

While in command-mode, the duration of a measurement campaign can be defined. Recording of data may begin at a certain start time and last until a certain stop time or it may be controlled by an external trigger signal. In addition a recurring interval may be defined consisting of a recording time and a period duration.

After all these parameters have been set, GEOLON is activated using the REC command. This puts GEOLON into recording-mode.

<day month year hour minute second> START or STOP

defines the beginning and the end of a recording sequence. The parameters <day>, <month> etc. are entered as two digit decimal numbers (e.g: 1 = 01, etc), separated by blanks before START or STOP.

ENDLESS
erases the START and STOP time settings. Thereafter, recording can be controlled using the commands REC and END.

REC
puts GEOLON into "recording-mode" using the parameters which have been entered previously and which may be displayed using the SETTINGS command. A new recording sequence is started with its unique initialisation block containing all TEXTINFO description strings as well as the time of synchronisation.

If START and STOP times have been defined, actual data recording will be delayed until the start time has elapsed. It will continue until the stop time has been reached. If no start time has been defined, recording will start immediately. When no stop time has been defined, recording will continue until either

1. the END command is issued
2. the harddisk is full
3. the batteries are empty.

If REC has been issued, the LED will start to blink. While GEOLON is in standby-mode (not recording data because the start time has not been reached or because it is in an inactive interval period) the LED blinks three times in four seconds. While data are recorded the LED blinks twice each second. The LED will be switched off automatically after 15 minutes, when no key has been pressed within this period and DTR-signal of the RS232 interface has been deactivated. The LED will remain off until DTR is set or any key will be pressed.

If a start time has been defined, GEOLON will go into sleep-mode as soon as the DTR-signal of the RS232 interface is deactivated. This dramatically reduces power consumption, only powering the internal oscillator maintaining time synchronisation until the start time has been reached.

END
finishes a recording sequence. All data buffers are saved on the storage cards and GEOLON returns to command-mode. The green LED lights permanently again. Now power may be removed without loss of data. As an interactive command it can't be compiled into user-commands and will be ignored in that context.

COMMENT <string>"
defines <string> as a comment. It may be up to 40 characters long. <string> is delimited by either a " or <cr>. EXPComment generates the same result.

EXPERIMENT <string>"
defines <string> as experiment name. It may be up to 24 characters long. <string> is delimited by either a " or <cr>. EXPname generates the same result.

6.5 Interval Definitions

During a recording sequence data may be recorded only part of the time at recurring intervals. In an interval pause, when no data is being recorded, GEOLON remains to be fully operational and does not go into sleep-mode.

EVERY [<n1> SEC] [<n2> MIN]
sets the duration of a measurement period.

FOR [<n1> SEC] [<n2> MIN]
sets the recording duration in each period beginning at the starting point of the period.

INTERVAL
closes the definition of a recording interval.

CONTINUOUS
resets the interval definitions to allow continuous recording again.

Example: EVERY 120 MIN FOR 10 SEC 20 MIN INTERVAL

EXTERNAL
prepares GEOLON for recording via the external trigger signal instead of via START and STOP time definitions. This recording persists after execution of REC until END is executed (for clarification: Please note that GEOLON will remain in command-mode until the REC command is executed).

When in recording-mode, data will be recorded as long as a "high"-level on the trigger input (Pin7 on the 15-pin Auxiliary connector) is present. GEOLON may record several events in sequence by activating and deactivating the trigger input.

Executing START, STOP or ENDLESS will deactivate the trigger input again.

6.6 Displaying Data

With the following command, the proper operation of the sensor electronics may be checked.

<n> SHOW
displays data of channel <n> (1 - 4) on the PC using the program **SENDCOM.EXE**.
^C (ctrl-C) will terminate the command. If you activated the three geophone channels with 3 CHANNELS or GEOPHONE CHANNELS then you can choose 1,2 or 3 for <n> to select and show one of the geophone components on the screen.

While GEOLON is recording, no data will be displayed during interval pauses.

For further information, please see: 5.1 SENDCOM.EXE

6.7 Time and Storage Services

GEOLON has one internal oscillator from which all timing information is derived.
A 100 kHz signal derived from this oscillator can be compared and adjusted to an external reference oscillator via Pin6 of the 15-pin Auxiliary connector.

After power-on, GEOLON is not synchronised as far as time and date is concerned. This can be accomplished using a DCF77 compatible pulse train. Synchronisation will be maintained as long as the power supply is not interrupted for more than 15 seconds.

<day month year hour minute second> SYNCHRONISE
synchronises the internal clock to an external synchronisation pulse. The pulse must be applied either to the DCF77 (low-to-high transition) or the -DCF77 (high-to-low transition) input. The time and date information entered as numbers before the command will be the time and date to which GEOLON will be set by the synchronisation pulse.
After time synchronisation has been finished, FORMAT will be executed automatically.
Example: A datum of 26 September 2003, 16:05:30 o'clock can be entered as
26 9 3 16 5 30 synchronise

DCF77
synchronises the internal oscillator. A DCF77 time-pulse coded signal must be connected to either Pin10 (active high) or Pin3 (active low) of the 15-pin Auxiliary connector. This synchronisation process may last up to 2 minutes due to the slow DCF77 pulse pattern.

During the synchronisation process one line of information is displayed:

synchronised - time and date: - <sec> - <min> - <hour> - <day> - <month> - <year>

Time synchronisation as well as the actual recording status will be maintained as long as the power supply for GEOLON is not interrupted for more then 15 seconds.
After time synchronisation has been finished, FORMAT will be executed automatically.

GPS
synchronises the internal oscillator. Now, a GPS time-pulse coded signal must be connected to Pin3, and the NMEA String information to pin 7 (and GND at pin 11) of the 15-pin Auxiliary connector.
During the synchronisation process one line of information is displayed:

synchronised - time and date: - <sec> - <min> - <hour> - <day> - <month> - <year>

Time synchronisation as well as the actual recording status will be maintained as long as the power supply for GEOLON is not interrupted for more then 15 seconds.
After time synchronisation has been finished, FORMAT will be executed automatically.

FORMAT
The internal harddisk of GEOLON will be initialised. Former data records will be overwritten. FORMAT can only be carried out after the application of DCF77 or SYNCHRONISE.

CLOSE
This command closes the disk for recording. It is not possible to repeat the REC command after carrying out the CLOSE command. CLOSE cannot be carried out during recording.

DRIFT
After carrying out the DCF77 or before using the SKEW command, the Drift command can be used to check the deviation in milliseconds of the internal oscillator and circuitry from the external DCF77 time pulse. The displayed deviation value will not be stored.

DCFSKEW
determines the deviation in milliseconds of the internal oscillator and clock circuitry compared to an external signal on the DCF77 or -DCF77 input pins. The skew value will be stored in the log file on the harddisk.

See also chap. 5.3.1 and the appendix.

GPSSKEW
determines the deviation in milliseconds of the internal oscillator and clock circuitry compared to an external signal on the **GPS** input pins. The skew value will be stored in the log file on the harddisk.

If the skew grows beyond a certain limit, the procedure asks whether an **automatic calibration** of the clock should be carried out or not.

<day month hour minute second> RELEASE
sets the time for the release pulse. When the RELEASE time has been reached, a logic TTL signal (active-high) will be generated at pin 8 of the auxiliary socket.

6.8 Definition of TEXTINFO Parameters

A number of descriptive character strings can be set which will be stored in non-volatile memory. These strings are stored in every recording sequence and copied or read together with the data file.

TEXTINFO
lists all entries in the following TEXTINFO parameter fields. The nomenclature for the entries are defined according to the PASSCAL file standard.

<n> ExpNumber
sets the Experiment-Number. <n> may be up to 2 digits long.

<n> StatNumber
sets the Station-Number. <n> may be up to 4 digits long.

StatName <string>"
defines <string> as Station-Name. <string> may be up to 24 characters long and it is delimited by either " or a <cr>.

StatComment <string>"
defines <string> as Station-Comment. <string> may be up to 40 characters long and it is delimited by either " or a <cr>.

<n> ChanName <string>"
defines <string> as Channel-Name of the <n>th channel. <string> may be up to 10 characters long and it is delimited by either " or a <cr>. <n> may be between 1 and 4.

<n> ChanComment <string>"
defines <string> as Channel-Comment of the <n>th channel. <string> may be up to 40 characters long and it is delimited by either " or a <cr>. <n> may be between 1 and 4.

6.9 Power Management

After connecting MES to the power supply, the MES waits for a DTR signal before it will start the boot sequence. The DTR signal will be provided by a terminal program (like SENDCOM) via the RS232 connector.

SHUTDOWN
This command allows switching off the GEOLON in a closed pressure cylinder. For this, the RS232 interface must be linked to an external connector at the housing.

SHUTDOWN activates a mode, which is waiting for the disconnection of the RS232 connector (e.g. at the PC or at the pressure housing) or the termination of SENDCOM. Therefore, the program is looking for the presence of a DTR signal at the RS232 interface. If there is no signal, the GELON will be powered down. The only remaining process is probing for the DTR signal. This process consumes very low power of about 0,004 W. Therefore the connection to a power supply has to be maintained. As soon as the RS232 interface is reconnected to a PC and the SENDCOM program is running, the GEOLON will wake up again.

6.10 Maintenance

Due to ongoing development of both the MES recorder´s operating system and firmware, or in case of a malfunction, it may be neccessary to provide the MES with a new operating system and/or firmware. Both can be transferred to the hard drive of the recorder by firewire, using the mesupload program that comes along with the SEND2X software suite. As of OS-version 1.07, the recorder will no longer load these files automatically, to prevent boot-loops. Instead, two new commands have been introduced:

OS-UPDATE
This command loads a new operating system from a corresponding file on the internal harddrive into the recorder. The MES will reboot automatically after installing the new operating system. See the SEND2X manual for details of the procedure.

FW-UPDATE
This command loads a new firmware from a corresponding file on the internal harddrive into the recorder. The MES will reboot automatically after installing the new operating system. See the SEND2X manual for details of the procedure.

7 Description of a Typical Operation Session

7.1 Interactive Operation via External PC

7.1.1 Software Preparation

Install the software from the disk delivered with GEOLON-MES on your PC. The different programs are described in chap. 5. For communication with the PC please use **SENDCOM**. It can be used for interactive configuration of GEOLON and for defining measurement sequences. The program-library **SEND2X** is used for conversion of recorded data into binary, audio wave or SEG-Y files.

7.1.2 Hardware Preparation

Connect GEOLON to the PC you want to use for interactive operation via the RS232 interface by means of a 9-pin modem extension cable.

Connect GEOLON to the external power supply specified in chap. 3.1.

The GEOLON-MES does not start until a DTR signal is sent by a terminal program to the RS232 interface. Therefore the SENDCOM program has to be started before the recorder will boot automatically with the last stored settings. However, if you got trouble with the last settings and would like to reset the system, keep the space key on your keyboard pressed while the GEOLON-MES is booting. A dialogue will be displayed that allows to restore the default system settings:

SendCom version 2.20
File View Connect port Help
GEOLON-MES SN:041107 OS ver. 1.09 06.09.2006 (c) SEND GmbH
GEOLON-MES SN:041107 FW ver. 1.09 19.09.2006 (c) SEND GmbH
cold unsynchronised

Connect the auxiliary signals necessary for your measurement project to the interface described in chap. 3.4. Connect at least the input for time synchronisation (pin 3).

7.1.3 Preparation of a Measurement Campaign

For measurement campaign preparation, the A/D converter has to be configured and the measurement parameters have to be defined. Configuration data and parameters of the measurement sequence are stored in non-volatile memory. Consequently, GEOLON will always boot with its last configuration as default settings. During measurement campaigns, a steady power supply is required. However, GEOLON will tolerate short power-fails of up to 30 seconds without losing its time base and resume recording after the power supply is re-established.

Configuring the A/D Converter

The A/D converter has to be configured concerning the necessities of the experiment (see chap. 6.3). In particular

- the number of channels
- the gain for the analogue preamplifier
- and the sampling rate

have to be defined.

Definition of a measurement sequence
The measurement sequence is defined by using suitable commands for operation and setting appropriate parameters. For details see chaps. 6.4, 6.5, 6.6, and 6.7. In addition, several descriptive parameters of the experiment or survey can be entered via TEXTINFO character strings according to chap. 6.8.

7.2 Stand-Alone Data Acquisition

GEOLON is designed for stand-alone data recording following a previously defined configuration and parameterisation (as described above).

The power supply through batteries should be sufficient for the predicted duration of the measurement campaign; otherwise the experiment could be interrupted before completion. In addition, the measurement sensors have to be connected to the configured analogue input channels.

Note: GEOLON's harddisk will always be repartitioned and reformatted during initialisation on GEOLON to ensure a sound, defragmented file-system. The GEOLON will preserve the configuration-file on the harddisk, reading it first and storing it again after the harddisk has been initialised.

Before starting data recording, a time synchronisation according to chap. 6.7 has to be performed (see there the commands DCF77, GPS or SYNCHRONISE). This is done by connecting a DCF77 or a GPS receiver with an output for a time pulse signal to the auxiliary connector. Be aware that GEOLON may lose its time synchronisation if power is removed for more than 30 sec and in this case, no recording will take place!

The REC command puts GEOLON into „recording mode“ using the parameters defined before, respectively the settings of the last recording (default values). If a START time has been defined (chap. 6.4) before, the GEOLON will now be switched into the stand-by modus. At START time, the recorder will wake up and begins data recording.
Once the REC command has been entered, the RS232 cable can be disconnected.

The duration of the measurement campaign usually is defined using commands described in chaps. 6.4 and 6.5. Otherwise, data recording will be continued until either the harddisk is full or the battery almost empty. In either case, GEOLON will properly finish the recording by writing all data from the internal buffers to disk before shutting down. The power consumption during shutdown is reduced to a minimum because only the internal time base is maintained. Normally, this still allows execution of a SKEW command later on. (To recover from shutdown-mode, the supply-voltage has to be raised to nominal level.)

In addition, the green LED on top between the RS232 and Auxiliary connector is sending different blinking signals according the stand alone status:

Signal	Meaning of signal
————————	(continuous ON) = ready for operation
flickering	access to harddisk and execution of commands
. . . . .	(continuous short) = recording
_ _ _ _ _ _ _ _ _ _	(continuous long) = stop during recording

7.3 Data retrieval via external PC

After the end of a measurement survey, the GEOLON MES has to be connected to a DCF77 or GPS receiver (via the auxiliary socket). Then the serial link has to be established to your computer (via the RS232 socket). After that, please start the program SENDCOM on your PC.
The command **DCFSKEW** determines the deviation of the internal oscillator compared to an external signal on the DCF77 or -DCF77 input pins. Alternatively, **GPSSKEW** can be used with a valid GPS signal. After determining the deviation, the data file on the harddisk is closed and the recording parameters and error messages are written to the Log-File.

7.3.1 Data retrieval via FireWire

By establishing the Firewire connection to the GEOLON, your PC should be able to provide direct access to GEOLON's harddisk and recognise it as own new device. Consequently, it is also possible to read and copy the data without a connection to the GEOLON via the RS232 interface, when the IEEE interface at your computer provides a power supply (only possible with a 6 pin to 6 pin FireWire cable).

Please note, that the FireWire link has the priority over commands which need an access to the harddrive: Several commands as 'synchronise' or 'skew' don't work while the FireWire link is established. This also applies to the MES boot process. Booting up the MES with FireWire connected will only show the ROM-messages and then be suspended until the FireWire link has been disconnected.

Please, also be aware that, if you send the command 'format' once, it´s execution will be suppressed only for the period where the FireWire connection is established. When you disconnect the FireWire cable, the suppressed command will be executed!

Up to now, the operation via FireWire 800 is not tested and a proper data handling cannot be guaranteed. Due to the hugh amount of different products, the operation via PCMCIA-FireWire interface is also not tested for all adapters available in the market. If you experience difficulties with one of the latter types of interfaces, please get in touch with SEND.
For example, there are some reports that the PCMCIA-FireWire Card of ATEN cannot set up a proper link to the MES.

If your computer only has a FireWire interface without power supply (e.g. with a 4 pin plug), then you have to connect the MES to an external power supply. In addition, the MES needs a DTR-signal at his RS232 connector. Otherwise, it will not wake up. Connecting a second computer via RS232 to the MES and starting SENDCOM under WINDOWS can provide this signal. Another possibility is connecting your LINUX PC to the MES via RS232 and starting the LINUX version of

SENDCOM, or a terminal-program like MINICOM, which also communicates with the MES via the serial interface. The latter is recommended, since copying the data from the MES to a PC requires utilization of a LINUX PC anyway, the filesystem of the MES-harddrive cannot be read with a WINDWOS PC. Please also note, that under LINUX you may have to work with root privileges to perform this type of hardware related tasks. Section 7.4 gives a short overview over data retrieval and conversion, as described in detail in the accompanying SEND2X manual.

7.4 Analysis of Recorded Data

After recording the stored data can be read using an external PC with an IEEE 1394 FireWire interface and the **SEND2X** software suite for the LINUX operating system. The program meslog of the Send2x-library provides a glance at the Log-File on the screen of the connected PC. Either you use the program mescopy to copy the raw data to your PC as it is, or you combine the program mesread with segywrite to convert the raw and compressed data into a standard SEG-Y format. Regarding these programs, please follow the instructions in chap.5.2 and the corresponding appendix. As of now, all programs of SEND2X are running under the LINUX operating system. Users who do not have a LINUX operated computer may request a KNOPPIX CD-R from us. KNOPPIX allows booting a working LINUX environment directly from CD-R.

7.5 Examples

The following experiment is assumed to be due for preparation:

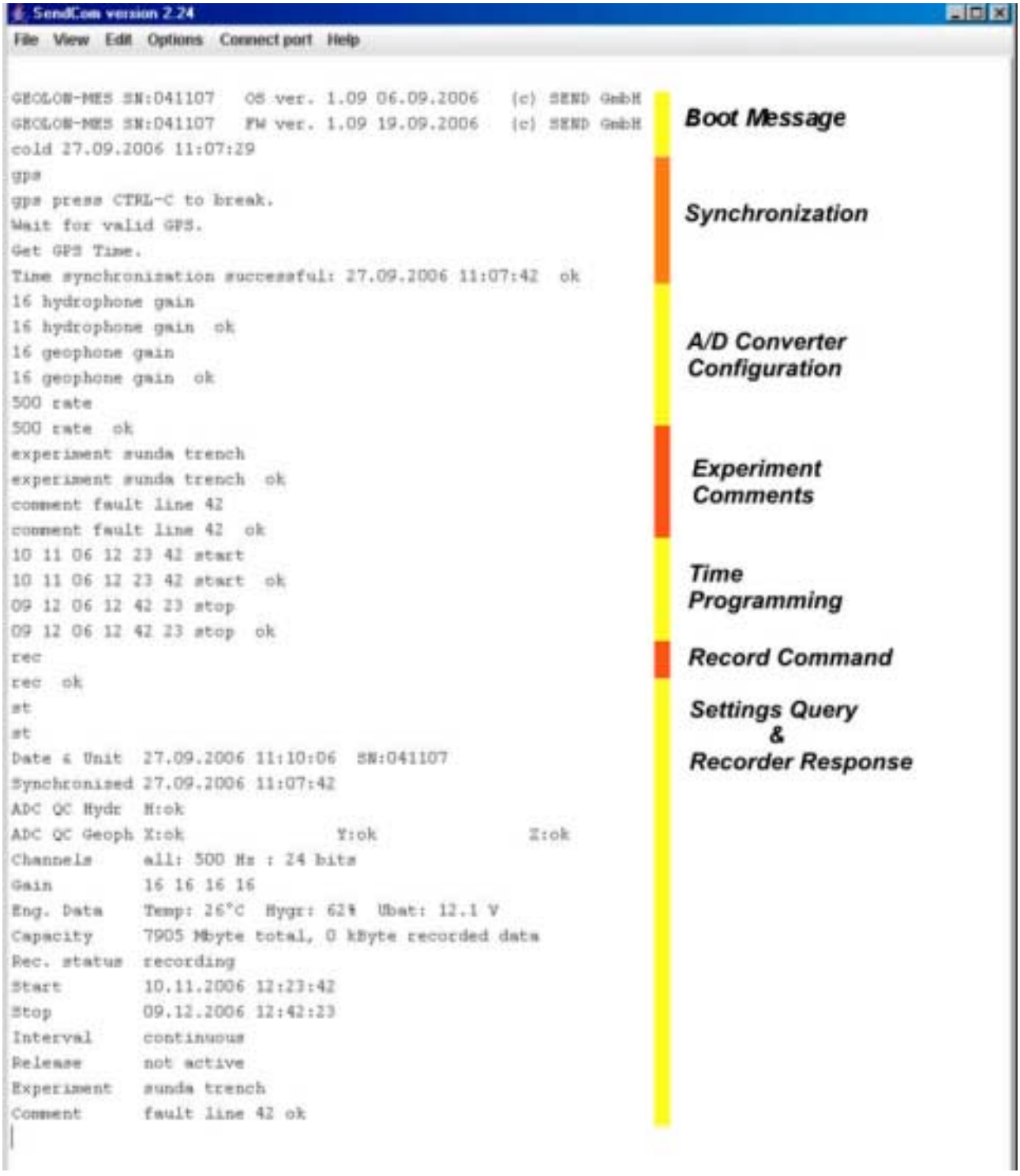
Configuration A/D converter:
4 channels
gain 16 for each of the 4 channels
sample rate 500

Measurement sequence:

Experiment comment:	fault line 42
Experiment name:	sunda trench
Start time:	November 11th, 2006, 12 h, 23 min, 42 sec
Intervals:	None
Stop time:	Dezember 9th, 2006, 12h, 42min, 23 sec

Time synchronisation

Performing the preparation as described above by issuing the commands with the appropriate parameters will result in the monitor responses shown on the next page.


SendCom version 2.24
File View Edit Options Connect port Help
GEOLON-MES SN:041107 OS ver. 1.09 06.09.2006 (c) SEND GmbH
GEOLON-MES SN:041107 FW ver. 1.09 19.09.2006 (c) SEND GmbH
cold 27.09.2006 11:07:29
gps
gps press CTRL-C to break.
Wait for valid GPS.
Get GPS Time.
Time synchronization successful: 27.09.2006 11:07:42 ok
16 hydrophone gain
16 hydrophone gain ok
16 geophone gain
16 geophone gain ok
500 rate
500 rate ok
experiment sunda trench
experiment sunda trench ok
comment fault line 42
comment fault line 42 ok
10 11 06 12 23 42 start
10 11 06 12 23 42 start ok
09 12 06 12 42 23 stop
09 12 06 12 42 23 stop ok
rec
rec ok
st
st
Date & Unit 27.09.2006 11:10:06 SN:041107
Synchronised 27.09.2006 11:07:42
ADC QC Hydr H:ok
ADC QC Geoph X:ok Y:ok Z:ok
Channels all: 500 Hz : 24 bits
Gain 16 16 16 16
Eng. Data Temp: 26°C Hygr: 62% Ubat: 12.1 V
Capacity 7905 Mbyte total, 0 kByte recorded data
Rec. status recording
Start 10.11.2006 12:23:42
Stop 09.12.2006 12:42:23
Interval continuous
Release not active
Experiment sunda trench
Comment fault line 42 ok
Boot Message
Synchronization
A/D Converter Configuration
Experiment Comments
Time Programming
Record Command
Settings Query & Recorder Response

Example of a mes.log file

```
29.02.2000 00:51:23 : Synctime : 0 secs : 29.02.2000 00:00:00
29.02.2000 00:51:23 : Format : successful : total : 18 Mb
29.02.2000 00:51:28 : settings
Date & Unit  29.02.2000 00:51:28
Synchronised 29.02.2000 00:00:00
ADC QC      H: ok
ADC QC      X: ok
ADC QC      Y: ok
ADC QC      Z: ok
Channels     all: 1000 Hz : 24 bits
Gain         1 1 1 1
Capacity     19077 Mb total, 19077 Kb remaining
Start        immediately
Stop         endless
Interval     continuous
Release      not active
Program      INTERACTIVE
Experiment   experiment_name
Comment      experiment_comment
29.02.2000 00:51:30 : Start sequence at block : 64
29.02.2000 00:53:26 : Stop sequence at block : 80
29.02.2000 00:53:57 : settings
Date & Unit  29.02.2000 00:53:57  FFFFFF
Synchronised 29.02.2000 00:00:00
ADC QC      X :  ok
ADC QC      Y :  ok
ADC QC      Z :  ok
Channels     geophone: 500 Hz : 24 bits
Gain         X 1 1 1
Capacity     19077 Mb total, 19077 Kb remaining
Start        immediately
Stop         endless
Interval     continuous
Release      not active
Program      INTERACTIVE
Experiment   experiment_name
Comment      experiment_comment
29.02.2000 00:54:00 : Start sequence at block : 80
29.02.2000 00:57:14 : Stop sequence at block : 95
```

8 Support and Service

Should any problem arise with the GEOLON-MES or its software, please contact us for bug reporting or any other support issue via:

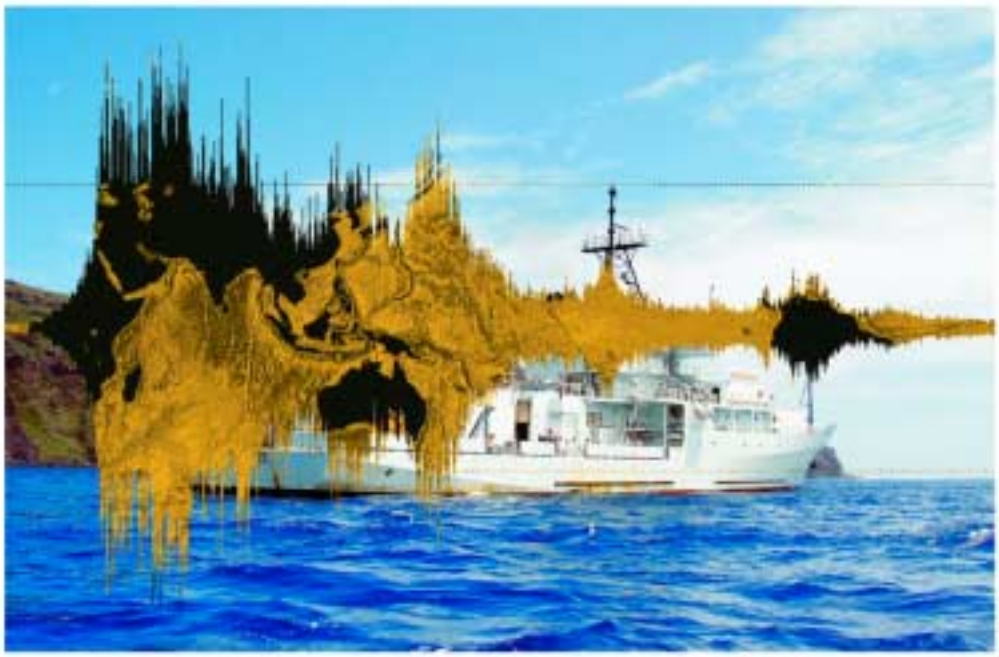
e-mail: support@send.de

phone: +49 40 375 008 23

fax: +49 40 375 008 93

9 Appendix: SEND2X manual

SEND2X



Data handling and conversion suite for Geolon Recorders

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Version 2.61

This program-package converts the compressed recordings of the SEND data loggers into different formats. SEND2X **version 2.60** is available for the Linux operating system.

This version allows the conversion of raw data into a binary file, an audio-wave file, a special Reftek SEG-Y format for seismological data and into the standard SEG-Y format if an appropriate shot file is available.

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1.1.10 smtsread 16
1.1.11 mcsupload 16
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This manual includes the description of utilities, which are required to save and process the data of SEND's data loggers Methusalem-MBS, Geolon-MCS, Geolon-MES, Geolon-MLS and Geolon-MTS.

On the delivered CD-R you will find a program-library and a script, which includes an example of combining the different programs. Each of the programs can be used separately.

The library consists of the device specific files

for the Geolon-**MCS**:

mcscopy, mcslog, mcsread and mcsupload

for the Geolon-**MES**:

mescopy, meslog and mesread

for the Geolon-**MLS**:

mlsread

for the Geolon-**MTS/MTS-M**:

mtsread, smtsread and pressure2ascii

for the Geolon-**MBS**:

mbsread

The device-dependent programs can only be used while working with the corresponding device and the data retrieved can then be further processed with the following device independent programs:

binwrite

wavewrite

seg-ywrite

gsewrite

paswrite

sacwrite

resample

All programs use the standard input as input device, and the standard output as output device most of the time. This allows an easy combination of the different programs by 'pipeing'.

Specific Linux issues

To allow handling of files larger than 20 Gbytes and more, please format the harddisk of your Linux computer with the maximum cluster and sector size. Also, depending on your Linux distribution, it might be necessary to work with root-privileges when performing hardware related tasks, e.g. retrieving data from IEEE1394 drives utilized by the MES data recorder.

Installing the programs

The programs can simply be copied from the distribution CD-ROM to the harddrive of your Linux system, e.g. to /usr/send2x/bin. It is recommended that you append your path-variable with the path to the send2x files. Example: ***PATH = $PATH:/usr/send2x/bin***

1.1 Description of individual programs

In the following description, the symbols

< > will be used to include variables which should be entered.

< > are also used as symbols for standard in- and output as part of the command.

The option **`--help`** can be used for all listed programs to display a brief description of the program on the screen.

1.1.1 mcscopy

This program module copies all recorded data from Geolon-MCS's harddisk via standard input and standard output to the harddisk of your computer. For the execution of mcscopy, the standard input has to be assigned to the device path and file of the Firewire interface, which is directly connected to the MCS's harddisk (e.g. /dev/*devicefile*). Also, the standard output has to be assigned to the destination directory and file on your computer. We recommend '.raw' as extension for the data file on your harddisk. For example:

`mcscopy < /dev/sda > <`*`working_directory/data_file_name.raw`*`>`

In the case of a corrupted data file (e.g. due to an unclosed file, system crash or reboot of the MCS while recording data), mcscopy will not be able to determine the correct size of the data file. Therefore, mcscopy displays a comment, requesting to enter an estimated file size and to restart mcscopy using the option:

`--save` *`<file size in Mbytes>`*

The file size can be estimated using the following calculation:

<File size in MBytes> =<sample rate in Hz> * 0.33 * <recording days> * <active channels> +50

1.1.2 mescopy

This program module copies all recorded data from Geolon-MES's harddisk via standard input and standard output to the harddisk of your computer. For the execution of mescopy, the standard input has to be assigned to the device path and file of the Firewire interface, which is directly connected to the MES's harddisk (e.g. /dev/*devicefile*). Also, the standard output has to be assigned to the destination directory and file on your computer. We recommend '.raw' as extension for the data file on your harddisk. For example:

`mescopy < /dev/sda >` *`<working_directory/data_file_name.raw>`*

In the case of a corrupted data file (e.g. due to an unclosed file, system crash or reboot of the MES while recording data), mescopy will not be able to determine the correct size of the data file. Therefore, mescopy displays a comment, requesting to enter an estimated file size and to restart mescopy using the option:

`--save` *`<file size in Mbytes>`*

The file size can be estimated using the following calculation:

<File size in MBytes> =<sample rate in Hz> * 0.33 * <recording days> * <active channels> +50

1.1.3 mcslog

Mcslog displays the MCS-log file on the screen of your PC. The log file includes the settings, control, status, and identification information of all experiments, which were carried out since the last disc format (synchronization). To copy the log file to your computer instead of displaying it on the screen, the standard output has to be redirected to a file on your PC. For executing mcslog, the standard input has to be assigned to the device path and file of the Firewire interface, which is connected to the MCS.

For example:

`mcslog < /dev/sda`

displays the log-file on the screen and

`mcslog < /dev/sda >` *<directory/log_file_name.txt>*

copies the log file to the harddisk of your computer.

1.1.4 meslog

Meslog displays the MES-log file on the screen of your PC. The log file includes the settings, control, status, and identification information of all experiments, which were carried out since the last disc format (synchronization). To copy the log file to your computer instead of displaying it on the screen, the standard output has to be redirected to a file on your PC. For executing meslog, the standard input has to be assigned to the device path and file of the Firewire interface which is connected to the MES.

For example:

`meslog < /dev/sda`

displays the log-file on the screen and

`meslog < /dev/sda >` *<directory/log_file_name.txt>*

copies the log file to the harddisk of your computer.

1.1.5 mcsread

This program module reads, decompresses and converts the raw data (recorded by Geolon-MCS) into the internal send2x format. In addition, it generates an ASCII file, containing the acquired engineering data (for a detailed description see: "1.3 Files").

Again, the program can read the compressed raw data via standard input through the Firewire interface from the MCS's harddisk. To do this, the standard input has to be assigned to the Firewire device connecting the MCS to the PC. Alternatively, the standard input can be assigned to the data file, which was stored by mcscopy on the harddisk of your computer. The converted data will be transferred to the standard output. Again, the standard output can be assigned to a destination file.

For example:

`mcsread < <raw_data_ file> >` *<directory/file_name.s2x>*

Because the decompression and conversion of the raw data needs more processing time than the simple copy procedure, we recommend to use mcscopy at first and then to use mcsread as the next processing step.

mcsread includes the following options (values in <> are variables which must be entered):

--begin_sec *<integer in GPS seconds>*

or

--begin_date *<formatted_time_string_yyyy.mm.dd_hh:mm:ss>*

together with

--end_sec *<integer in GPS seconds>*

or

--end_date *<formatted_time_string_yyyy.mm.dd_hh:mm:ss>*

Using these options restricts the data conversion to the time-window of interest. The resulting file will contain only data within this time window. We recommend to use the time of the first and the last shot of a survey-line.

GPS seconds means the number of seconds since GPS start on January 6th 1980, 00:00 o'clock.

Examples:

--begin_sec 708669934 --end_sec 708685565

or

--begin_date 2002.06.21_04:45:34 --end 2002.06.21_09:06:05

--skew *<+/-_skew_time_in_µs>*

This option allows to store a manually entered skew value in the send2x file instead of the skew value from the raw data file.

Example: **--skew -1000**

Instead of the skew value of the raw data file, a skew value of -1 ms will be recorded in the send2x file.

--timeshift *<+/-value_in_seconds>*

The use of this option allows to shift all data by a constant time. The value has to be in full seconds (integer value). Use this command for the correction of differences in time, if different time standards have been used for synchronising the data logger and for synchronising the airgun controller on the shooting vessel.

Example: GPS-RTS delivers the time in UTC, the shooting vessel provides the shot time as GPS time. The difference between these two time standards is 14 seconds and therefore, you have to enter:

`--timeshift 14`

`--no_eng`

The engineering data will be stored automatically in a file in the current working directory with a filename according to chapter 1.3.2.

The option **`--no_eng`** suppresses the automatic file generation.

`-- log` *<filename>*

This option generates a log-file of the current mcsread-run in the current working directory. Without using the option, the log-file will be written automatically to the file "mcsread.log".

`--no_log`

No log file will be generated.

1.1.6 mesread

This program module reads, decompresses and converts the raw data (recorded by Geolon-MES) into the internal send2x format. In addition, it generates an ASCII file, containing the acquired engineering data (for a detailed description see: "1.3 Files").

Again, the program can read the compressed raw data via standard input through the Firewire interface from the MES's harddisk. To do this, the standard input has to be assigned to the Firewire device connecting the MES to the PC. Alternatively, the standard input can be assigned to the data file, which was stored by mescopy on the harddisk of your computer. The converted data will be transferred to the standard output. Again, the standard output can be assigned to a destination file.

For example:

`mesread <` *<raw_data_ file>* **`>`** *<directory/file_name.s2x>*

Because the decompression and conversion of the raw data needs more processing time than the simple copy procedure, we recommend to use mescopy at first and then to use mesread as the next processing step.

mesread includes the following options (values in <> are variables which must be entered):

`--begin_sec` *<integer in GPS seconds>*

or

`--begin_date` *<formatted_time_string_yyyy.mm.dd_hh:mm:ss>*

together with

`--end_sec` *<integer in GPS seconds>*

or

--end_date *<formatted_time_string_yyyy.mm.dd_hh:mm:ss>*

Using these options restricts the data conversion to the time-window of interest. The resulting file will contain only data within this time window. We recommend to use the time of the first and the last shot of a survey-line. Mesread internally subtracts 60 seconds from 'begin time' and adds 60 seconds to 'end time' (the time window thus becomes: begin-60secs till end+60secs).

GPS seconds means the number of seconds since GPS start on January 6th 1980, 00:00 o'clock.

Examples:

--begin_sec 708669934 --end_sec 708685565

or

--begin_date 2002.06.21_04:45:34 --end 2002.06.21_09:06:05

--skew *<+/-_skew_time_in_µs>*

This option allows to store a manually entered skew value in the send2x file instead of the skew value from the raw data file.

Example: **--skew -1000**

Instead of the skew value of the raw data file, a skew value of -1 ms will be recorded in the send2x file.

--timeshift *<+/-value_in_seconds>*

The use of this option allows to shift all data by a constant time. The value has to be in full seconds (integer value). Use this command for the correction of differences in time, if different time standards have been used for synchronising the data logger and for synchronising the airgun controller on the shooting vessel.

Example: GPS77 delivers the time in UTC, the shooting vessel provides the shot time as GPS time. The difference between these two time standards is 14 seconds and therefore, you have to enter:

--timeshift 14

--no_eng

The engineering data will be stored automatically in a file in the current working directory with a filename according to chapter 1.3.2.

The option **--no_eng** suppresses the automatic file generation.

-- log *<filename>*

This option generates a log-file of the current mesread-run in the current working directory. Without using the option, the log-file will be written automatically to the file "mesread.log".

--no_log

No log file will be generated.

1.1.7 mbsread

Mbsread has to be used to convert raw data acquired by the Methusalem-MBS data logger. At first, the raw data of all PCMCIA cards of one recording session as well as one of the MBS.SYS files must be copied to a directory using e.g. the cp command. Then mbsread is used to decompress and convert the raw data into the internal send2x format.

Mbsread reads the raw data from either the current directory or from the directory specified by the --src option. The converted data will be transferred to the standard output, which usually will be re-directed to a destination file.

For example:

mbsread --src *<directory>* **>** *<directory/file.s2x>*

mbsread includes the following options (values in <> are required variables):

--src *<directory>*

specifies the directory, which is used as raw data input. --src may be omitted if the input comes from the current directory. The directory must contain all raw data files, which may have been copied from multiple PCMCIA cards belonging to one recording session as well as the MBS.SYS file from one of the PCMCIA cards.

--help displays a list of all options with brief explanations

--begin_sec *<integer_in_GPS_seconds>*

or

--begin_date *<formatted_string_yyyy.mm.dd_hh:mm:ss>*

--end_sec *<integer_in_GPS_seconds>*

or

--end_date *<formatted_string_yyyy.mm.dd_hh:mm:ss>*

Using these options restricts the data conversion to the time-window of interest. The resulting file will contain only data within this time window. We recommend to use the time of the first and the last shot of a survey-line. Mbsread internally subtracts 60 seconds from 'begin time' and adds 60 seconds to 'end time' (the time window thus becomes: begin-60secs till end+60secs).

GPS seconds means the number of seconds since GPS start on January 6th 1980, 00:00 o'clock.

Example:

--begin_sec 708669934 --end_sec 708685565

or

--begin_date 2002.06.21_04:45:34 --end 2002.06.21_09:06:05

--skew *<+/-_skew_in_µs>*

This option allows to store a manually entered skew value in the send2x file instead of the skew value from the raw data file(s).

Example: **`--skew -1000`**

Instead of the skew value of the raw data file, a skew value of -1 ms will be recorded in the send2x file.

`--timeshift` *<+/-value_in_seconds>*

The use of this option allows to shift all data by a constant time. The value has to be in full seconds (integer value). Use this command for the correction of differences in time, if different time standards have been used for synchronising the data logger and for synchronising the airgun controller on the shooting vessel.

Example: GPS77 delivers the time in UTC, the shooting vessel provides the shot time as GPS time. The difference between these two time standards is 14 seconds and therefore, you must enter:

`--timeshift 14`

`--log` *<filename>*

This option generates a log file of the current mbsread run in the current directory. Without using this option, the log file will be written "mbsread.log".

`--no_log`

No log file will be generated.

`--nc`

If this option is used, no messages will be produced when mbsread is executed.

1.1.8 mlsread

Mlsread has to be used to convert raw data acquired by the GEOLON-MLS data logger. At first, the raw data of all PCMCIA cards belonging to one recording session as well the corresponding MLS.SYS file must be copied to a directory using e.g. the cp command. Then mlsread is used to decompress and convert the raw data into the internal send2x format.

Mlsread reads the raw data from either the current directory or from the directory specified by the --src option. The converted data will be transferred to the standard output, which usually will be re-directed to a destination file.

For example:

mlsread --src *<directory>* **>** *<directory/file.s2x>*

mlsread includes the following options (values in <> are required variables):

--src *<directory>*

specifies the directory, which is used as raw data input. --src may be omitted if the input comes from the current directory. The directory must contain all raw data files, which may have been copied from multiple PCMCIA cards belonging to one recording session as well as the MLS.SYS file from one of the PCMCIA cards.

--help or **-h** displays a list of all options with brief explanations

--begin_sec *<integer_in_GPS_seconds>*

or

--begin_date *<formatted_string_yyyy.mm.dd_hh:mm:ss>*

--end_sec *<integer_in_GPS_seconds>*

or

--end_date *<formatted_string_yyyy.mm.dd_hh:mm:ss>*

Using these options restricts the data conversion to the time-window of interest. The resulting file will contain only data within this time window. We recommend to use the time of the first and the last shot of a survey-line. Mlsread internally subtracts 60 seconds from 'begin time' and adds 60 seconds to 'end time' (the time window thus becomes: begin-60secs till end+60secs).

GPS seconds means the number of seconds since GPS start on January 6th 1980, 00:00 o'clock.

Example:

--begin_sec 708669934 --end_sec 708685565

or

--begin_date 2002.06.21_04:45:34 --end 2002.06.21_09:06:05

--skew *<+/-_skew_in_µs>*

This option allows to store a manually entered skew value in the send2x file instead of the skew value from the raw data file(s).

Example: **`--skew -1000`**

Instead of the skew value of the raw data file, a skew value of -1 ms will be recorded in the send2x file.

`--timeshift` *<+/-value_in_seconds>*

The use of this option allows to shift all data by a constant time. The value has to be in full seconds (integer value). Use this command for the correction of differences in time, if different time standards have been used for synchronising the data logger and for synchronising the airgun controller on the shooting vessel.

Example: GPS77 delivers the time in UTC, the shooting vessel provides the shot time as GPS time. The difference between these two time standards is 14 seconds and therefore, you must enter:

`--timeshift 14`

`--log` *<filename>*

This option generates a log file of the current mlsread run in the current directory. Without using this option, the log file will be saved as "mlsread.log".

`--no_log`

No log file will be generated.

`--nc`

If this option is used, no messages will be produced when mlsread is executed.

1.1.9 mtsread

Mtsread has to be used to convert raw data acquired by the GEOLON-MTS/MTS-M data logger. At first, the raw data of all PCMCIA cards belonging to one recording session as well as the corresponding MLS.SYS file must be copied to a directory using e.g. the cp command. Then mtsread is used to decompress and convert the raw seismic data into the internal send2x format.

The raw data of the absolute pressure gauge will be converted into ASCII format and stored in a separate file. The name of this file will be generated automatically with the channel number 5 and the extension **.pressure** (see also chap. 1.3.3).

The resulting ASCII file looks like this:

```
************************************************************
time                    pressure (mBar)
------------------------------------------------------------
13:30:13 16.08.2005      1088.6
13:30:28 16.08.2005      1088.7
13:30:43 16.08.2005      1088.8
13:30:58 16.08.2005      1088.9
.................          ...
************************************************************
```

Mtsread reads the raw data from either the current directory or from the directory specified by the --src option. The converted data will be transferred to the standard output, which usually will be re-directed to a destination file.

For example:

mtsread --src *<directory>* **>** *<directory/file.s2x>*

mtsread includes the following options (values in <> are required variables):

--src *<directory>*

specifies the directory, which is used as raw data input. --src may be omitted if the input comes from the current directory. The directory must contain all raw data files, which may have been copied from multiple PCMCIA cards belonging to one recording session as well as the MLS.SYS file from one of the PCMCIA cards.

--help displays a list of all options with brief explanations

--begin_sec *<integer_in_GPS_seconds>*

or

--begin_date *<formatted_string_yyyy.mm.dd_hh:mm:ss>*

--end_sec *<integer_in_GPS_seconds>*

or

--end_date *<formatted_string_yyyy.mm.dd_hh:mm:ss>*

Using these options restricts the data conversion to the time-window of interest. The resulting file will contain only data within this time window. We recommend to use the time of the first and the last shot of a survey-line.

GPS seconds means the number of seconds since GPS start on January 6th 1980, 00:00 o'clock.

Example:

--begin_sec 708669934 --end_sec 708685565

or

--begin_date 2002.06.21_04:45:34 --end 2002.06.21_09:06:05

--skew *<+/-_skew_in_µs>*

This option allows to store a manually entered skew value in the send2x file instead of the skew value from the raw data file(s).

Example: **--skew -1000**

Instead of the skew value of the raw data file, a skew value of -1 ms will be recorded in the send2x file.

--timeshift *<+/-value_in_seconds>*

The use of this option allows to shift all data by a constant time. The value has to be in full seconds (integer value). Use this command for the correction of differences in time, if different time standards have been used for synchronising the data logger and for synchronising the airgun controller on the shooting vessel.

Example: Your GPS receiver delivers the time in UTC, the shooting vessel provides the shot time as GPS time. The difference between these two time standards is 14 seconds and therefore, you must enter:

--timeshift 14

--log *<filename>*

This option generates a log file of the current mtsread run in the current directory. Without using this option, the log file will be stored in a file with the name "mtsread.log".

--no_log

No log file will be generated.

--nc

If this option is used, no messages will be produced when mtsread is executed.

`--report_slips`

This option starts a reporting of time slip messages on the screen during the conversion of the data.

For a description of time slips, please see the chap. "Time Slips" in the MTS Manual.

1.1.10 smtsread

This programs converts data sequences that have been requested from a MTS-M tsunameter seismocorder in an ocean bottom unit (OBU) by the buoy computer´s OBUD program. It works similar to mtsread, just without mls.sys file information, which is replaced by the header information in the data sequence file.

Data in- and output can be pipes or files only, with no additional parameters:

EXAMPLE:

smtsread </data/inputfilename >/data/outputfilename

1.1.11 mcsupload

This program allows uploading of user programs to the Geolon-MCS via the IEEE1394-interface. The order of options is not important. Options are.

--usp <*filename*>

This option defines the filename of the user program if StdIn is not used.

--log <*filename*>

This option defines the name of the logfile. If this option is not given, “mcsupload.log” will be used by default.

EXAMPLES:

mcsupload </data/user.mcs >/dev/*mcsdevice*

mcsupload –usp /data/user.mcs >dev/*mcsdevice*

mcsupload –p /var/log/mcs/mcsupload.log –usp /data/user.mcs >dev/*mcsdevice*

1.1.12 mesupload

This program allows uploading of user programs, new operating system software and new firmware versions to the Geolon-MES via the IEEE1394-interface. Options are.

--usp <*filename*>

This option defines the filename of the user program if StdIn is not used.

--rom <*filename*>

This option defines the filename of the operating system software to be loaded.

--fw <*filename*>

This option defines the filename of the firmware to be loaded.

EXAMPLES:

mesupload </data/user.mes >/dev/*mesdevice*

mesupload --usp /data/user.mes >dev/*mesdevice*

mesupload --fw /data/mes113a_fw.mes >dev/*mesdevice*

Please note, that new operating system software and new firmware will not be installed automatically by the MES recorder. Please consult the MES manual for details, how to store these files from the internal harddrive to nonvolatile memory.

1.1.13 binwrite

This program has to be used to convert the data from internal send2x format into 32 bit binary format. It reads the data via standard input and writes for each activated channel and each recording period (sequence) a file into a destination directory. The filenames are generated automatically. Corresponding to chapter 5.3.3, they consist of the recorder's serial number, channel no, sequence no and the date and time of recording-start. Furthermore, each file will be marked by the extension '.bin'. Following options are important:

`--dest` *`<path/destination directory/>`*

This option defines the destination directory.

`--no_head`

The application of no_head suppresses the text header in the output file. Otherwise, a header of 1024 Byte will be written.

1.1.14 wavewrite

As binwrite, wavewrite also reads the data from standard input. But now, the data will be converted into a 16 bit PCM wave (audio wave) format and stored in a separate file for each channel. The filenames will be generated automatically. Corresponding to chapter 5.3.3, the filename consists of the recorder's serial number, channel no, sequence no and the date and time of recording-start. In addition, each file will be marked by the extension '.wav'.

Options:

`--dest` *<path/destination directory/>*

This option defines the directory in which the converted data files will be stored.

`--lower`

Please use this option, if you would like to preserve the 16 least significant bits of the 24 bit data. Without using this option, wavewrite neglects the 8 least significant bits (as default).

1.1.15 seg-ywrite

This program module converts the internal send2x format into SEG-Y format. The program requires a shot file for cutting the long raw data stream into single traces. Please find a description of the shot file structure at the end of this chapter.

If no shot file is available, a single and long SEG-Y trace can be generated using the option --reftek.

As well as the other writing programs, seg-ywrite reads the data via standard input and writes for each activated channel and for each recording period (sequence) a file into a destination directory. The filenames will be generated automatically and marked by the extension '.segy'. Each filename consists of the recorder's serial number, channel no, sequence no and the date and time of recording-start, using the nomenclature as described in chapter 5.3.3.

Options:

`--dest` *<path/directory/>*

Please enter the complete path to and the name of the destination directory where the resulting (converted) files should be stored.

`--shot` *<path/directory/filename>*

Please enter the directory and filename where the shot file is located.

`--tracelen` *<number of samples>*

The option --tracelen allows to cut all traces to a common length.

Example: --tracelen 2000

will write traces consisting of 2000 samples.

The resulting trace length in seconds can be calculated by:

trace length in ms = (number of samples) * (sample period in ms)

e.g.: (2000)*(4ms)=8000 ms trace length

`--fill_null`

If the entered trace length in option --tracelen is longer than the time period between two shots, the option --fill_null can be used to fill the traces with zeros (0) up to the defined trace length.

Following the SEG-Y standard, the trace length can not exceed 32767 samples.

`--reftek`

This option stores the complete data in one single trace. As this file can be longer than 32767 samples, it is not written in standard SEG-Y. Instead of this, the file is compatible to the file format provided by the program REF2SEGY of REFTEK. Especially the trace headers are modified. The option --reftek can not be used in combination with --shot. Please note, that only the start-time of the first sample of the one single trace will be corrected by the automatic skew correction.

`--msb`

converts the data in 2byte, two's complement integer format, whereas only the most significant 16 bits will be copied.

`--lsb`

converts the data in 2byte, two's complement integer format, whereas only the least significant 16 bits will be copied.

`--trace_cut` *<value in seconds>*

If no shot file is available and the raw data should be cut into traces to display the data as 'seismic section', then the option --trace_cut can be used. Thereby the long raw data stream will be cut into traces of equal length, given by the entered number of seconds. The value has to be in full seconds (integer value). The option --trace_cut can not be used in combination with --reftek or --shot.

`--skew` *<+/- skew in µs>*

If you enter --skew 0, the program will apply no skew correction and ignores the skew-value written in the raw data file.

If you don't use this option, the skew value written in the raw data will automatically be used to correct the start time of each trace.

Example: --skew -1000

Instead of processing the skew value supplied with the raw data, the skew correction will now be performed using a skew value of -1 ms. Please note, that with the –reftek option, the skew is treated the same way as when using traces, no matter whether the skew is entered manually oder taken

from the raw data automatically: The proportional skew per second is calculated and used to determine the start sample for the output file.

--gcx *<integer value>*

Please enter the x coordinate for the geophone group (here for the OBS location), if available.

--gcy *<integer value>*

Please enter the y coordinate for the geophone group (here for the OBS location). if available

Following the SEG-Y standard, the x and y coordinates have to be in seconds of arc, if spherical coordinates are used. Then, the x value should represent longitude and the y-value latitude. A positive value designates the number of seconds east of Greenwich Meridian or north of the equator and a negative value designates the number of seconds south or west.

--data_le

This option controls the byte order in the data area of the resulting SEG-Y file:

Without using the option, seg-ywrite stores the trace header and the data in "Big Endian" format (recommended for PC's).

By using --data_le, the data will be written in "Little Endian" format.

--le

Both, data and header will be written in "Little Endian" format.

--out_int

If this option will be used, then the data in the SEGY- file will be written in 4-byte, two's complement integer format. Without using the option, the data will be written in "IEEE floating point" format (as default).

--log *<filename>*

This option generates a log file of the current seg-ywrite run in the current directory. Without using this option, the log file will be stored in a file with the name "seg-ywrite.log".

1.1.16 gsewrite

The gsewrite module converts data from the send2x format to GSE (Group of Seismic Experts) standard file format. It reads data from standard input and writes the output into files. For each active channel in the raw data, a separate GSE file will be written, using the standard nomenclature for file names as described in chapter 5.3.3. Optionally, a customized file name can be created using the - - nameform option. Target files will be written to the current directory unless a target directory is spezified using the - - dest option.

Usage:

```
gsewrite [options] <rawdata.s2x
```

Options:

-- dest PATH or -d PATH	Sets output for target files to given path/directory
-- nameform FORM or –n FORM	Sets file name format according to format string FORM.
	FORM is a string literal which may not contain spaces or whitespace. It can take up any ASCII characters and the following placeholder symbols:
	%n device serial number
	%c channel number
	%q record sequence number
	%v event number
	%e experiment number
	%E experiment name
	%t station number
	%T station name
	%Y year of the first sample
	%J julian day of the first sample
	%D day of month of the first sample
	%M month of the first sample
	%h hour of the first sample
	%m minute of the first sample
	%s seconds of the first sample
	%g gain value
	%r sample rate of recording
	%p sample period (in micro seconds) of recording
	The default setting to form filenames according to chapter 5.3.3. thus is: %n.%c.%q.%v.%Y%J.%h.%m.%s.gse
--split SEC or –t SEC	split the output files into segments of <SEC> seconds worth of samples each

--slice SIZE or -c SIZE	slice the output files into segments of <SIZE> megabytes size each
--verbose or -v	verbose mode with additional information for debugging
--version or -V	print version information and exit
--silent or -s	suppresses all regular message output
--help or -h	display this help and exit

1.1.17 paswrite

The paswrite module converts data from the send2x format to PASSCAL data format. It reads data from standard input and writes the output into files. For each active channel in the raw data, a separate PASSCAL file will be written, using the standard nomenclature for file names as described in chapter 5.3.3. Optionally, a customized file name can be created using the - - nameform option. Target files will be written to the current directory unless a target directory is spezified using the - - dest option. Finally, a multiplexed target file, containing interleaved data from all channels, can be written using the –multiplexed option. By default, the 16 most significant bits from each sample will be written to the target file, unless the --lsb option is used to switch to the 16 least significant bits from each sample.

Usage:

paswrite [options]<*infile*

or

paswrite [-h] [-V]

Options:

-- dest PATH or -d PATH	Sets output for target files to given path/directory
-- nameform FORM or –n FORM	Sets file name format according to format string FORM.

FORM is a string literal which may not contain spaces or whitespace. It can take up any ASCII characters and the following placeholder symbols:

%n	device serial number
%c	channel number
%q	record sequence number
%v	event number
%e	experiment number
%E	experiment name
%t	station number
%T	station name
%Y	year of the first sample
%J	julian day of the first sample
%D	day of month of the first sample
%M	month of the first sample
%h	hour of the first sample
%m	minute of the first sample
%s	seconds of the first sample

	%g gain value %r sample rate of recording %p sample period (in micro seconds) of recording The default setting to form filenames according to chapter 5.3.3. thus is: %n.%c.%q.%v.%Y%J.%h.%m.%s.passcal
--split SEC or –t SEC	split the output files into segments of <SEC> seconds worth of samples each
--slice SIZE or -c SIZE	slice the output files into segments of <SIZE> megabytes size each
--lsb or –l	only write the 16 least significant bits of samples to target file
--msb or –m	only write the 16 most significant bits of samples to target file
--multiplexed or –x	write data from all channels into a single target file
--verbose or -v	verbose mode with additional information for debugging
--version or -V	print version information and exit
--silent or -s	suppresses all regular message output
--help or -h	display this help and exit

1.1.18 sacwrite

The sacwrite module converts data from the send2x format to SAC (Seismic Analysis Code) data format. It reads data from standard input and writes the output into files. For each active channel in the raw data, a separate SAC file will be written, using the standard nomenclature for file names as described in chapter 5.3.3. Optionally, a customized file name can be created using the - - nameform option. Target files will be written to the current directory unless a target directory is spezified using the - - dest option. Optionally, the geographic location of the station may be provided as input parameter.

Usage:

sacwrite [options]<*infile*

or

sacwrite [-h] [-V]

Options:

-- dest PATH or -d PATH	Sets output for target files to given path/directory
-- nameform FORM or –n FORM	Sets file name format according to format string FORM.

FORM is a string literal which may not contain spaces or whitespace. It can take up any ASCII characters and the following placeholder symbols:

%n	device serial number
%c	channel number
%q	record sequence number
%v	event number
%e	experiment number
%E	experiment name
%t	station number
%T	station name
%Y	year of the first sample
%J	julian day of the first sample
%D	day of month of the first sample
%M	month of the first sample
%h	hour of the first sample
%m	minute of the first sample
%s	seconds of the first sample
%g	gain value

	%r sample rate of recording %p sample period (in micro seconds) of recording The default setting to form filenames according to chapter 5.3.3. thus is: %n.%c.%q.%v.%Y%J.%h.%m.%s.sac
--split SEC or -t SEC	split the output files into segments of <SEC> seconds worth of samples each
--slice SIZE or -c SIZE	slice the output files into segments of <SIZE> megabytes size each
--latitude <deg> or -a <deg>	set latitude of station to <deg> degrees, where <deg> is a floating point number with north being a positive value
--longitude <deg> or -o <deg>	set longitude of station to <deg> degrees, where <deg> is a floating point number with east being a positive value
--verbose or -v	verbose mode with additional information for debugging
--version or -V	print version information and exit
--silent or -s	suppresses all regular message output
--help or -h	display this help and exit

1.1.19 resample

Data recorded with the GEOLON-MLS and GEOLONON-MTS or MTS-M may show so-called "time slips", due to differences between the long term stabilization of the internal clock and the sample frequency clock. Thus, within a given sample period, less or more samples than required are recorded. e.g. 99 samples instead of 100. If this misalignment of sample periods and samples actually collected is influencing the precision of your experiment, you can correct the data using RESAMPLE. RESAMPLE does not correct time slips for other GEOLON Data Loggers, but may be helpful for correction of filter influences and adjusting skew times.

Usage:

resample [-v] [-s *size*] [-c *seconds*] <*infile* >*outfile*

or

resample [-h] [-V]

Options:

-h Help. Displays a list of all available options.

-V Version. Displays the version number of resample

-v Verbose. Displays process information on stderr

-s Sets the size of the internal data buffer to *size* MB. Default value is 16MB.

-c Sets the time in *seconds*, which must pass between consecutive time slips before re-interpolation starts

Remarks:

With the GEOLON-MLS, -MTS or -MTS-M, either a –c value or a –s value, or both, must be given or the command will abort indicating an error. With the GEOLON MES and MCS, normally no parameters should be given, since by design they do not show time slips and you are likely to run into buffer memory problems when setting parameters.

RESAMPLE can react to three special situations:

1. Data gaps. In this case, RESAMPLE will handle the data before and after the gap as separate streams of data.
2. If the time between two time slips is larger than the time covered by the data in the internal buffer of RESAMPLE, an error message will be displayed. In this case, the –s parameter can

be used to increase the buffer size accordingly. Please note that there is one buffer for each channel of data, so the value for this parameter is limited by the total amount of real and virtual memory of the computer, divided by the number of channels recorded. It also means, that for large files with great distances between timeslips, the memory requirement can exceed the limits of any state of the art PC. In this case we suggest splitting the input file and trying to correct smaller snippets, which can later be reassembled by concatenation.

3. Frequent discrepancies. If time slips occur in rapid succession, typically with alternating signs (+1 sample, -1 sample, etc.), the number of samples between slips is insufficient for proper interpolation. In this case, the –s parameter be set to a threshold in seconds, that has to pass without a new time slip, before a new interpolation is done.

1.1.20 pressure2ascii

This programs converts sequences of pressure data that have been retrieved from a MTS-M tsunameter seismocorder in an ocean bottom unit (OBU) by the buoy computer´s OBUD program.

It writes the data as ascii-text into standard output or into a file with a filename of your choice.

The input file has to be generated by the OBUD software. These data files can be read by pressure2ascii using the --file option.

EXAMPLE:

pressure2ascii --file 765432_10.obud.2 >/data/outputtextfile

-whereas '765432_IO.obud.2' is a file stored by the OBUD software on the buoy computer after retrieving pressure data from the OBU.

- whereas ' /data/outputtextfile ' is a path and filename of your choice. If you leave this string in your command, the ASCII data will be piped into standard output.

The resulting ASCII file looks like:

```
date & time of first sample;06.02.2006 07:28:16
sample time;pressure (mBar)
0;1088,6
15;1088,7
30;1088,7
..;......
```

The start time of the measurement is noted in the first line of the file. The second line explains the sorting of the following data. The first value in the data lines stands for the seconds gone since the measurement was started.

1.2 Combining the programs

The concept to use standard input and output allows to hand over the data easily from program to program and to combine the program modules in 'pipes'.

Example 1:

$ mesread --begin 708669934 --end 708685565 < /dev/sdc | seg-ywrite --dest ~/segy_data/

--shot ~/shots/shotfile.txt --tracelen 2000

In this example, mesread cut out data from the raw data file on GEOLON's harddisk between the GPS time 708669934 seconds and 708685565 seconds and passes them over to seg-ywrite via standard output. Seg-ywrite cuts the data stream into traces of 2000 samples regarding the shot times in the shot-time file shotfile.txt. In the example this file is located in the subdirectory 'shots/' of your home directory. For each activated channel during recording, a file with the extension '.segy' will be stored in the directory ~/segy_data/. The complete sequence of commands could also be arranged in a script.

Example 2:

$ mesread --begin 708669934 --end 708685565 </dev/*devicefile* > ~/temp.s2x
$ seg-ywrite < ~/temp.s2x --dest ~/segy_data/ --shot ~/shots/shotfile.txt --tracelen 2000
$ wavewrite < ~/temp.s2x --dest ~/wave_data/

Here, mesread cut out data from the raw data file on GEOLON's harddisk (via Firewire connection, established through the *devicefile*) between the GPS time 708669934 seconds and 708685565 seconds and writes standard output into the file 'temp.s2x' in your home directory. In the second line you find the command to start seg-ywrite, which cuts the data stream into traces of 2000 samples regarding the shot times in the shot-time file shotfile.txt. The third line shows how the same file 'temp.s2x' can be used for data conversion into audio wave format. If you would use pipes to get the same result, mesread would be started twice: The first time in the pipe combining mesread with seg-ywrite and the second time combining mesread with wavewrite.

1.2.1 Structure of the shot file

Normally, the program uses a shot file for converting the raw data file in a file of single traces. The shot file has to contain the name of shooting-line (or profile), the shot point number, and shot time at minimum. Also the entry of the geographical coordinates of the shot points are possible. Together with the coordinates for the receiver, provided by the options --gcx and --gcy of seg-ywrite, the complete geographical positioning information of shot and receiver can be stored in the resulting SEG-Y file.

Shotfiles generally consist of a header line containing field descriptions and parameter options, followed by lines of data and terminated by a blank line containing a single carriage return.

Seg-ywrite can read following shot file formats:

1: GPS time in seconds.microseconds

LINENAME	SHOTPOINT	GPS-TIME:SEC
abcd-1234	1234	1234567.123456
abcd-1237	1237	1234597.123456
abcd-1314	1314	1234607.123456

2: GPS time in seconds.microseconds + coordinates of shotpoint

LINENAME	SHOTPOINT	GPS-TIME:SEC	X-COORDINATE	Y-COORDINATE
abcd-1234	1234	1234567.123456	374136	6456332
abcd-1237	1237	1234597.123456	374136	6456332
abcd-1314	1314	1234607.123456	374136	6456332

3: GPS time in year.month.day_hour:minute:second.microsecond

e.g.: 2003.05.07_06:14:49.123456

LINENAME	SHOTPOINT	GPS-TIME:DATE
abcd-1234	1234	2003.05.07_06:14:49.123456
abcd-1237	1237	2003.05.07_06:14:50.123456
abcd-1314	1314	2003.05.07_06:14:51.123456

4: GPS time in year.month.day_hour:minute:second.microsecond + coordinates of shotpoint

LINENAME	SHOTPOINT	GPS-TIME:DATE	X-COORDINATE	Y-COORDINATE
abcd-1234	1234	2003.05.07_06:14:49.123456	374136	6456332
abcd-1237	1237	2003.05.07_06:14:50.123456	374136	6456332
abcd-1314	1314	2003.05.07_06:14:51.123456	374136	6456332

The header line contains the following field discriptors:

`LINENAME:` The corresponding fields contain descriptive string up to 16 characters long.

`SHOTPOINT:` The corresponding fields contain an ASCII coded number up to 2147482648.

GPS-TIME: The corresponding fields contain ASCII coded time information. The colon-separated parameter options may be either **DATE** for a human-readable timeformat or **SEC** for time values in GPS seconds since start of service on January 5th, 1980.

The data format for the **SEC** option is SECONDS.MICROSECONDS.

The data format for the **DATE** option is YYYY.MM.DD_HH:MM:SS.ssssss, where

YYYY	holds the year as a four digit number
MM	holds the month as a two digit number with leading zero
DD	holds the day as two digit number with leading zero
HH	holds the hour as two digit number with leading zero
MM	holds the minute as two digit number with leading zero
SS	holds the seconds as two digit number with leading zero
ssssss	holds the microseconds as six digit number

Please note, that all GPS time formats have a common requirement: The microseconds must consist of figures with 6 numbers after the decimal point.

The program expects pure GPS-time, which is counted in seconds after 6th January 1980, 00:00 o'clock (start of GPS by USA). Often UTC is used instead of the GPS-time. UTC time is currently (in 2006) 14 seconds behind GPS Time, that means:

GPS-time = UTC + 14 seconds

When you use UTC-time for the synchronisation of the recorder and the GPS of the gun-boat delivers GPS-time, then 14 sec have to be added to your recorder-time (see option -timeshift) to get a comparable time basis.

X-COORDINATE: The corresponding fields optionally contain the x-coordinate of the shot position.

Y-COORDINATE: The corresponding fields optionally contain the x-coordinate of the shot position.

Following the SEG-Y standard, the x and y coordinates have to be in seconds of arc, if spherical coordinates are used. Then, the x value should represent longitude and the y-value latitude. A positive value designates the number of seconds east of Greenwich Meridian or north of the equator and a negative value designates the number of seconds south or west.

Seg-ywrite automatically recognises if your shot file contains only 3 columns instead of 5 (if no coordinates are available). The columns have to be separated by empty spaces or tabs.

Seg-ywrite writes four SEG-Y files, each containing the data of one channel.

If you have no shot file, please use the program option wavewrite. The resulting '.wav' file can be displayed using a sound-display program as for example COOLEDIT.

1.3 Files

The nomenclature of the automatically generated files will be described hereafter.

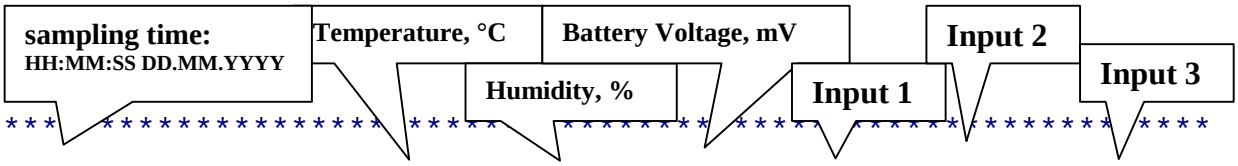
1.3.1 Log - File of Geolon-MES and Geolon MCS

All control, status, and identification information of the current experiment are stored on GEOLON's harddisk. Furthermore, the log data includes the parameter settings such as the sample rate and the amplifier gain for each channel. Normally the program meslog displays these data on the screen. Through the assignment of the standard output to the harddisk on the connected external PC, these data can alternatively be stored in a text-file. The user has to define the filename and the destination directory in the kind of *log file_ name*.txt.

1.3.2 Engineering data

The internal temperature and humidity as well as the battery voltage will be stored together with the recorded seismic data on the internal disk. The programs mesread and mcsread provide the extraction of the engineering data out of the recorded data stream. The file will automatically be written in the current working directory. The corresponding file name is described in chapter 1.3.3.

The engineering data file looks like:




```
***************************************************************************
time                    temp  hydr   ubat   ain1   ain2   ain3
06:14:49 07.05.2003      27    49   13623
06:15:49 07.05.2003      27    49   13623
 ..    ..    ....       ...   ...   ...     ...    ...     ...
***************************************************************************
```

Input 1-3: free channels for user defined input. For the GEOLON-MTS and MTS-M variants, the engineering data files contain the pressure values recorded for the corresponding pressure sensor.

1.3.3 Data Files

The programs binwrite, wavewrite and seg-ywrite generate automatically files with names of following nomenclature:

020806.01.00.01.2002.168.07.09.57.extension

serial number of GEOLON	channel no	sequence no	event no	start time of recording at activation of REC command	
					.bin for binary files **.wav** for audio wave files **.segy** for files in SEG-Y format **.eng** for engineering data of MES and MCS recorder **.pressure** for pressure data of MTS and MTS-M recorder

The start time of recording consists of:

the year 2002

number of days since the beginning of the year	168
the hour	07
minutes	09
seconds	57